User's Manual

3.5” ARM11 667Mhz SBC with

LAN
Four USB Hosts
LVDS
COM Ports
H.263/H.264/MPEG4 Codec
SD/SDHC
Audio

APC-6410

USER INFORMATION

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Introduction

This Chapter gives background information on the APC-6410
Section include：

- APC/XPC embedded ARM/XSCALE computer line family
- Block diagram

Chapter 1 Introduction

1.1 APC/XPC Embedded ARM/XSCALE Computer Line Family

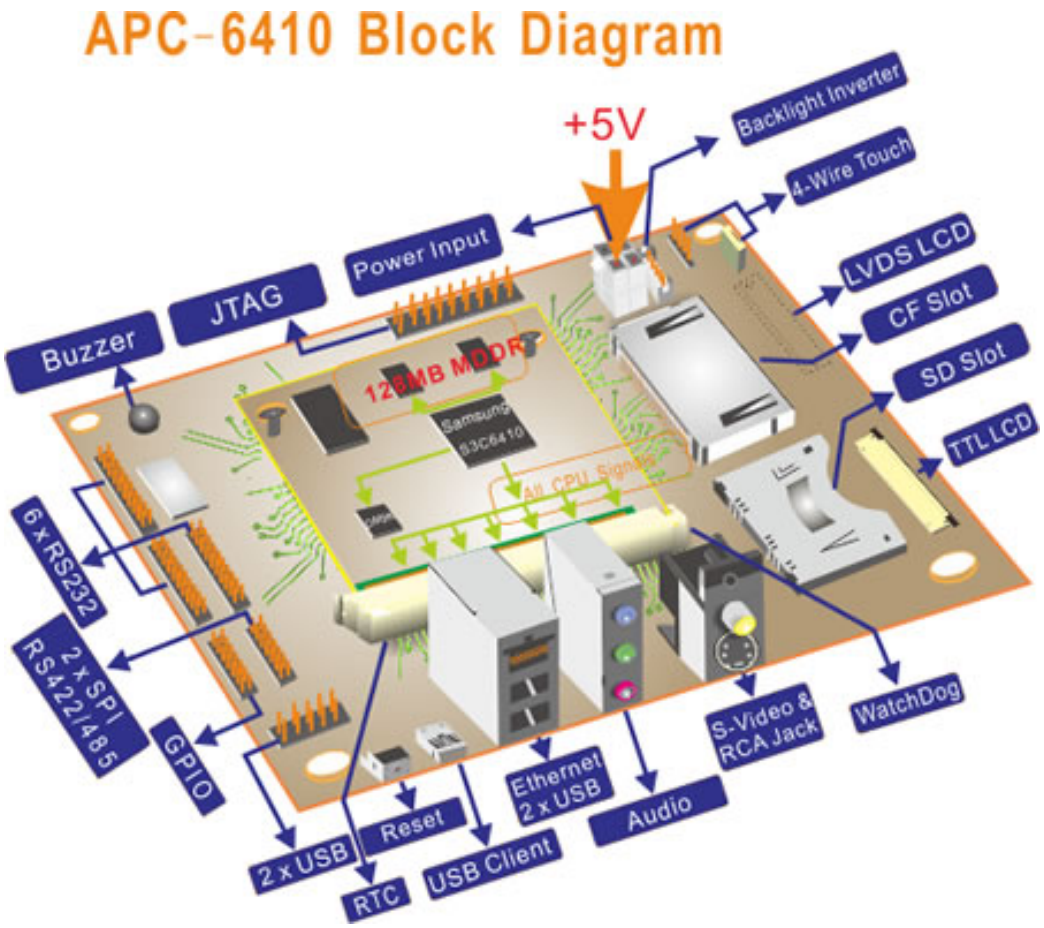
APC embedded ARM/XSCALE computers are a new concept, reliable, low power and powerful embedded ARM based 3.5” SBC family of EMBEDIAN. Every attempt is made to make it easy to use and like the experiences in x86 compatible SBC systems. Usually, users only need to re-compile the original source code.

The APC product line is designed to meet the needs of embedded networking and graphical systems developers. These embedded ARM/XSCALE computer line family allow the use of the same chassis over the whole product line and maximize design reuse. XPC embedded ARM/XSCALE computer use the on-board CPU, flash memory and mobile DDR. The SBCs themselves only need DC 5V to boot up.

1.2 Block Diagram

The following diagram illustrates the system organization of the APC-6410. Arrows indicate direction of control and not necessarily signal flow. Figure 1.1

Figure 1.1 Block Diagram



Details for this diagram will be explained in the following chapters.

Specifications

This Chapter contains specifications of APC-6410.
Section include：

- Functional specifications
- Mechanical specifications
- Electrical specifications
- Environmental specifications
- MTBF
- EMI/RFI and ESD protection

Chapter 2 Specifications

This chapter gives an overall specification for APC-6410. APC-6410 is an SBC based on Samsung S3C6410 ARM1176JZF-S core processor clocking at 667Mhz that integrated Multi Format Codec (MFC) co-processor supports encoding and decoding of MPEG4/H.263/H.264 and decoding of VC1. This H/W Encoder/Decoder supports real-time video conferencing and TV out for both NTSC and PAL mode. Additional graphic 3D engine is a 3D Graphics Hardware Accelerator which can accelerate OpenGL ES 1.1 & 2.0 rendering. APC-6410 features state of the art technology, aiming at low power systems that require high CPU performance. They also provide all the interfaces needed in a modern embedded device. It can be applied to the general-purposed embedded application or multimedia-related embedded application by taking advantages of the MFC co-processor. With Linux and Windows CE 6.0 supported, users can easily develop their original application from other platform or develop a new application on this platform.
The specification in this chapter includes functional, mechanical, electrical, and environmental specifications.

2.1 Functional Specifications

Processor

- On-board Samsung S3C6410
- ARM1176JZF-S core with Java acceleration engine and 16KB/16KB I/D Cache and 16KB/16KB I/D TCM
- Clock Rates up to 667Mhz
- 266Mhz 64/32-bit system bus architecture is composed of AXI, AHB and APB buses.
- Multi Format Codec (co-processor) provides encoding and decoding of MPEG-4/H.263/H.264 up to 30fps@SD/D1 and decoding of VC1 video up to 30fps@SD/D1.
- Manufactured using the 65nm process
- 2D graphics acceleration with BitBlit and rotation
- 3D graphics hardware accelerator which can accelerate OpenGL ES 1.1 & 2.0 rendering
- Vector Floating-Point (VFP) coprocessor support allowing efficient

implementation of various encryption schemes as well as high quality 3D graphics applications

Power Supply

- +5V VDC only
- Over Voltage Protection
- Real-time clock battery powered

Memory

- Onboard 128MB NAND Flash (SLC, Large Block)
- Onboard 128MB Mobile DDR (266Mhz 32-bit Connection, Optional 256MB is on Project-Based)
- CompactFlash(CF), Type I and Type II, 3.3V, Memory Mode and True IDE Mode

Universal Serial Bus (USB)

- Chipset：CPU internal
- Four USB 1.1 host ports (12Mbit/s speed), Two of them are type A connectors and two of them are 2.54mm pin headers
- OHCI Rev. 1.0 Compliance
- USB legacy keyboard, mouse and hard disk support

USB Device

- Chipset：CPU internal
- One USB client 2.0 port, mini-type connector onboard supporting high speed as Device (480Mbps, on-chip transceiver).
- Compatible with USB specification version 2.0

COM Port

- Chipset：TI TL16c752B and CPU internal
- Five RS232 ports, three 10x2-pin Headers (two of them are TX and RX only; one of them are TX, RX, CTS and RTS; and two of them are full RS232 from TI's chipset)
- One RS422/485 (5-wire) port, one 7x2-pin Header (TX, RX, CTS and RTS only and share with one RS232 port)

Ethernet

- Chipset：Davicom DM9000B

- RJ-45 connector onboard
- Compliance with IEEE 802.3u 100Base-TX and 802.3 10Base –T
- Compliance with IEEE 802.3u auto-negotiation protocol for automatic link-type selection
- Full-duplex/half -duplex capability
- Supports IEEE 802.3x full duplex flow control
- Support Auto-MDIX

CompavtFlash(CF) Socket

- Chipset：CPU CF controller
- One CF socket onboard
- Type I and Type II, 3.3V
- Memory mode and True IDE mode
- Compatible with CF+ and CompactFlash Spec (Rev 3.0)

SD Card Host Interface Socket

- Chipset：CPU SD controller
- 1 x SD/MMC Card Slot on board
- SD Memory Card Protocol version 2.0 compatible
- SDIO CARD Protocol version 1.0 compatible
- 128 word FIFO for Tx/Rx
- DMA based or Interrupt based operation
- 3 channel SD/MMC Host Controller
- Support CE-ATA Interface

Video Graphic Array (VGA)

- Chipset：CPU LCD controller
- TFT Panel/LVDS Support
- 800x600 resolutions
- TTL(16-bit) and LVDS (18/24-bit, default is 24-bit) interface on board
- Support 5 Window Layer for PIP or OSD
- Programmable OSC window positioning
- 16-level alpha blending

Video Post Processor

- Chipset：CPU LCD controller
- Video input format conversion
- Video/Graphic scaling up/down or zooming in/out

- Color space conversion from YCbCr to RGB and from RGB to YCbCr
- Dedicated scaler for TV Encoder

TV Out

- Chipset：CPU internal
- Support NTSC-M,J / PAL-B,D,G,H,I,M,Nc compliant video format
- S-Video Connector
- Built in the MIE(Mobile Image Enhancer) Engine

TV In (Only on Project-Based)

- Chipset：TI TVP5150AM1
- Accepts NTSC (M, 4.43), PAL (B, D, G, H, I, M, N), and SECAM (B, D, G, K, K1, L) compliant video data
- Connector: RCA jack

Audio

- Chipset：Realtek ALC203 Codec
- AC97 version 2.3 compliance interface
- High SNR (>100dB), 3D Stereo Enhancement
- Stereo Microphone Input
- Headphone Output
- Advanced Linux Sound Architecture (ALSA) API support

Discrete I/O

- 12 general-purpose digital I/Os

Multi Format Codec

- Chipset：CPU internal MFC co-processor
- MPEG-4 part-II simple profile encoding/decoding 30fps@SD/D1
- H.264/AVC baseline encoding/decoding 30fps@SD/D1
- H.263 profile3 encoding/decoding 30fps@SD/D1
- VC1 decoding 30fps@SD/D1
- Encoding tools
  - [-16,+16] 1/2 and 1/4 pel accuracy motion estimation using the full-search algorithm
  - Variable block sizes: 16x16, 16x8, 8x16 and 8x8
  - Unrestricted motion vector
  - MPEG-4 AC/DC prediction

- H.264/AVC intra-prediction (hardwired mode decision)
- In-loop deblocking filter for both H.264 and H.263 P3
- Error resilience tools
- MPEG-4 resync. Marker and data-partitioning with RVLC
- MPEG-4/AVC FMO
- Bit-rate control (CBR and VBR)

- Decoding tools
  -Support all features of the standards

JPEG Codec

- Chipset：CPU JPEG Codec co-processor
- Compression/decompression up to UXGA size
- Encoding format: YCbCr 4:2:2 / RGB565
- Decoding format: YCbCr 4:4:4/4:2:2/4:2:0 or gray

2D Graphic Accelerator

- Chipset：CPU internal
- Line/Point drawing, BitBLT and Color Expansion /Text Drawing

3D Graphic Accelerator

- Chipset：CPU internal
- 4M triangles/s @133MHz (Transform Only)
- 75.8M pixels/s fill-rates @133MHz (shaded pixels)
- Programmable Shader Model 3.0 support
- 128-bit (32-bit x 4) Floating-point Vertex Shader
- Geometry-texture cache support
- 128-bit (32-bit x 4) Floating-point two Fragment Shaders
- Max. 4K x 4K frame-buffer (16/32-bpp)
- 32-bit depth buffer (8-bit stencil/24-bit Z)
- Texture format: 1/2/4/8/16/32-bpp RGB, YUV 422, S3TC Compressed
- Support max. 8 surfaces (max. 8 user-defined textures)
- API Support: OpenGL ES 1.1 & 2.0, D3D Mobile
- Intelligent Host Interface
  - 15 input data-types, Vertex Buffer & Vertex Cache
- H/W Clipping (Near & Far)
- 8-stage five-threaded Shader architecture
- Primitive assembly & hard-wired triangle setup engine

- One pixels/cycle hard-wired rasterizer
- One texturing engine (one bilinear-filtered texel/cycle each)
- Nearest/bilinear/trilinear filtering
- 8-layered multi-texturing support
- Fragment processing: Alpha/Stencil/Z/Dither/Mask/ROP
- Memory bandwidth optimization through hierarchical caching
  - L1/L2 Texture-caches, Z/Color caches

Security Subsystem

- Chipset：CPU internal
- AES accelerator: ECB, CBC, CTR mode support
- DES/3DES accelerator: ECB, CBC mode support
- SHA-1 Hash engine
- H/W HMAC support
- Random Number Generator : PRNG 320-bit generation per 160 cycles
- FIFO-Rx/Tx: (two 32-word) for input and output streaming.
- DMA I/F to SDMA1(Security DMA 1)

SPI

- Chipset：CPU internal
- 2x7 pin header
- Compatible with 2-ch Serial Peripheral Interface Protocol version 2.11
- 2x8 bits Shift register for Tx/Rx
- DMA-based or interrupt-based operation

Watchdog Timer (WDT)

- Chipset：CPU internal
- 16-bit Watchdog Timer
- Interrupt Request or System Reset at Timeout

Touch Panel Interface

- Chipset：CPU Internal
- 10-bit CMOS ADC
- 4-wire FPC connector onboard

Buzzer

- Chipset：Advanced Acoustic Technology AS9051

- Rated Frequency at 2731 ± 200 Hz
- PWM Frequency Control
- Sound Output：85dBA (min)

CAN BUS (Only on Project Based)

JTAG

- Male 2.54 mm 2x10 header

Real Time Clock (RTC)

- Chipset：CPU internal
- RTC backup battery on board

BIOS

- Universal Bootloader (u-boot)
- Dual BIOS Support
- Ethernet TFTP download
- Booting from NAND Flash Technology
- Eboot (for Wondows CE 6.0)

Dimension

- Length x Width: 102mm x 145mm (4.0" x 5.7")

Operating System

- Linux 2.6.24 (Ubuntu Linux 9.04 Supports (BIOS, Kernel , rescue root filesystem stored in NAND flash and Rootfs in SD/SDHC card)
- Windows CE 6.0

Cross Tool

- Based on gcc 4.2.2
- Support EABI
- Support for Cortex-M1 (ARMV6-M) CPUs
- Improved code generation for Cortex-A8 and Cortex-R4 CPUs humb-2 GLIBC binaries

Package List

- 1 x APC-6410

- 1 x DUART Cable (Only on first purchase)

Document Deliverable

- uboot (source and binary)
- kernel (source and binary)
- nandfs
- root file systems
- cross toolchain
- user's manual

Ordering Information

- APC-6410 (normal temperature)
- APC-6410-E (extended temperature, -25^{o}C~8^{o}C)

2.2 Mechanical Specification

The APC-6410 series embedded ARM/XSCALE computer boards is standard 3.5" (102mm x 145mm) form factor in size. This section describes the component dimensions and mounting of the board. Detailed drawings are available from Embedian for production customers.

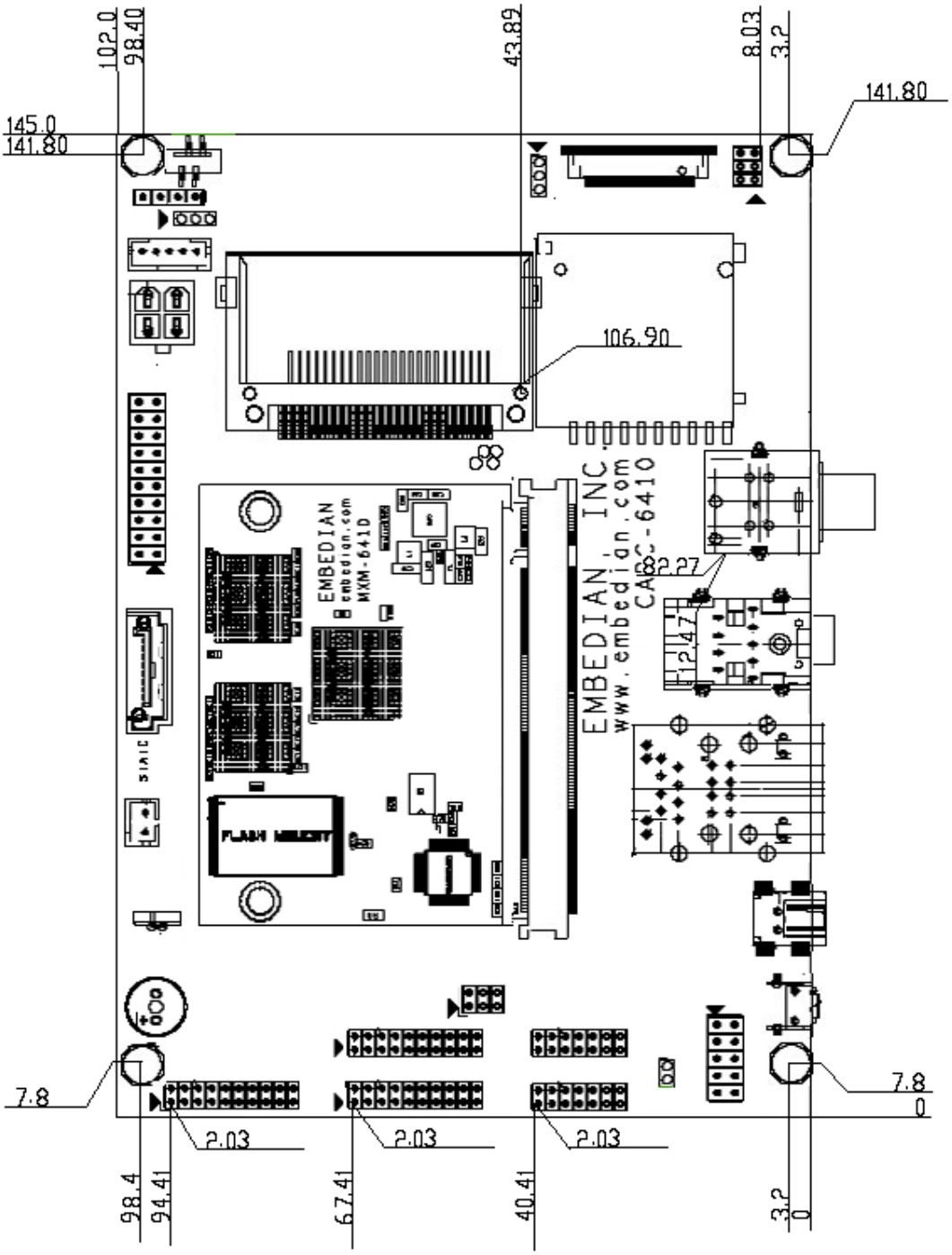
2.2.1. Dimensions

Length x Width: 102mm x 145mm (4.0" x 5.7")

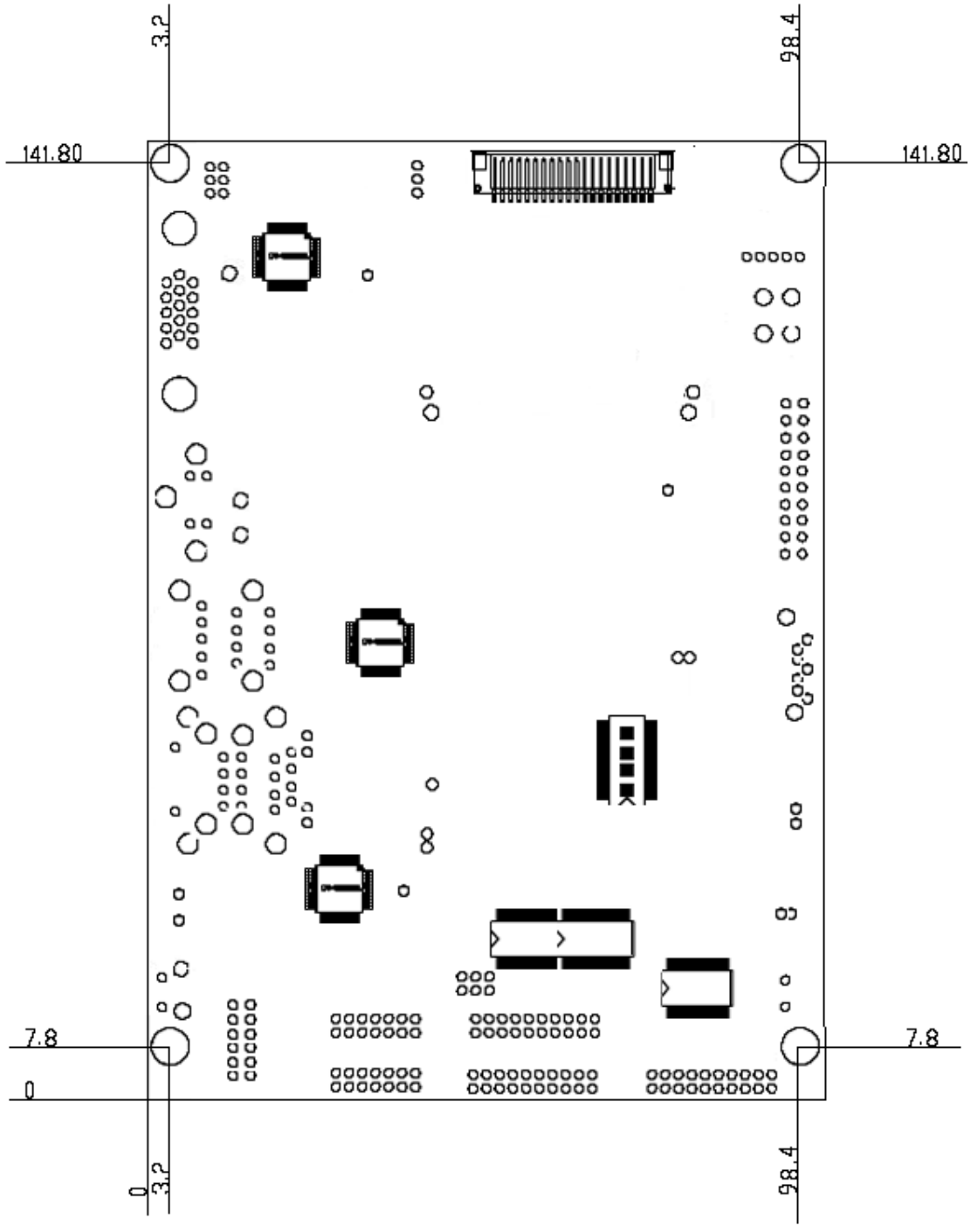
2.2.2. Mechanical Drawing

The following mechanical drawing specifies the dimension of APC-6410, as well as key components on the board. All dimensions are in mini-meters.

Top View


102.0
98.40
43.89
8.03
3.2
141.80
145.0
141.80
106.90
EMBEDIAN
embedian.com
MXM-6410
EMBEDIAN, INC.
www.embedian.com
82.27
12.47
7.8
0
2.03
2.03
2.03
98.4
94.41
67.41
40.41
3.2
0

Bottom View



2.2.3. Mounting Holes

Four mounting holes are provided for mounting. The diameter of the holes is 4.0 mm. Mounting holes are plated through and connected to the APC-6410 ground plane.

For reliable ground connections, use locking washers (star or split) when securing an APC-6410 in an enclosure. Make sure that the washers do not extend beyond the limits of the pads provided.

2.2.4. Clearances

The APC-6410 has a low profile. It can fit in an enclosure with inside dimensions as thin as 25.5 mm. Key clearances are as follows:

Height on Top

Max 38.25mm (1.51”)

Height on Bottom

Maximum 5.75mm (0.23”)

Board Thickness

1.6mm (0.06”)

Clearance over Top and Bottom

45.85mm (1.81”)

Note:

Selection of connectors and wiring harnesses will determine height of final assembly.

2.2.5. Weight

About 120g (full featured version)

2.3 Electrical Specification

2.3.1. Supply Voltages

- +5V DC ± 5%

APC-6410 embedded ARM/XSCALE computer boards are equipped with +5V DC only. The AT/ATX requires +5V only. The voltages +12V, -12V and –5V are not required to operate the APC-6410, but might need for other

external devices. APC-6410 also provides with a +5V and +12 V bypass path to backlight inverter board controller. (See next “Quick Start Guide”.)

2.3.2. Supply Voltage Ripple

100mV peak to peak 0 - 20MHz

2.3.3. Supply Current (Typical)

APC-6410 is a low power consumption embedded computer module. The power-consumption tests were executed to give an overview of the electrical conditions for several operational states.

The board used a 128MB onboard mobile DDR. Following table lists the typical power consumption of each APC-6410 SBC. All I/Os are up under the testing environment.

Table 2.1 Power Consumption of APC-6410 series SBC

	APC-6410
Power Consumption	*450mA/5V*

Note:

1. The tested LCD resolution is 800x600.

2.3.4. Real-Time Clock (RTC) Battery

- Voltage range: 1.8V – 43.6V (Typical@3.0V)
- Quiescent current: max. 3uA@3.0 V
- Normal Capacity：1.5mAh

2.3.5. CF

- 3.3V only

2.3.6. LCD

The LCD signal control voltage specification is as follows.

- +3.3/5V for TTL level LCD Panel
- +3.3/5V for LVDS LCD Panel

2.4 Environmental Specification

2.4.1. Temperature

- Operating: 0^{o} C to +70 ^{o} C(*) (with appropriate airflow)
- Non-operating: -10 to +85 ^{o} C (non-condensing)

Note:

(*) The maximum operating temperature is the maximum measurable temperature on any spot on the module's surface. You must maintain the temperature according to the above specification.

2.4.2. Humidity

- Operating: 0 to 95% (non-condensing)
- Non-operating: 0 to 95% (non-condensing)

2.5 MTBF

- System MTBF (hours) : >100,000 hours

The above MTBF (Mean Time Between Failure) values were calculated using a combination of manufacturer's test data, if the data was available, and a Bellcore calculation for the remaining parts. The Bellcore calculation used is "Method 1 Case 1". In that particular method the components are assumed to be operating at a 50 % stress level in a 40° C ambient environment and the system is assumed to have not been burned in. Manufacturer's data has been used wherever possible. The manufacturer's data, when used, is specified at 50^{o}C, so in that sense the following results are slightly conservative. The MTBF values shown below are for a 40^{o}C in an office or telecommunications environment. Higher temperatures and other environmental stresses (extreme altitude, vibration, salt water exposure, etc.) lower MTBF values.

2.6 EMI/RFI and ESD Protection

The APC-6410 incorporates a number of standard features that protect it from electrostatic discharge (ESD) and suppress electromagnetic and radio-frequency interference (EMI/RFI). Transient voltage suppressors, EMI fences, filters on I/O lines and termination of high-frequency signals are included standard on all systems.

APC-6410 provides surge protection on the input power lines of itself. This is especially important if the power supply wires will be subject to EMI/RFI or

ESD. If the system incorporates other external boards, it is the responsibility of the designer or integrator to provide surge protection on the system input power lines.

Quick Start Guide

To save developer’s time, this Chapter gives a quick start guide of APC-6410.

Chapter 3 Quick Start Guide

These quick start guides are intended to provide developers with simple instructions on how to install APC-6410 from very beginning and have it monitoring your local device inside of 20 minutes. No advanced installation options are discussed here - just the basics that will work for 95% of users who want to get started. This guide will lead you through the process of configuring, installing, and developing APC-6410. This guide was written to be as clear as possible and to provide only the details necessary to get you up and running with APC-6410. For more in-depth information, links to other chapters will be located where appropriate. This chapter includes two parts. This first part is Linux users and the second part is for Windows CE 6.0 users.

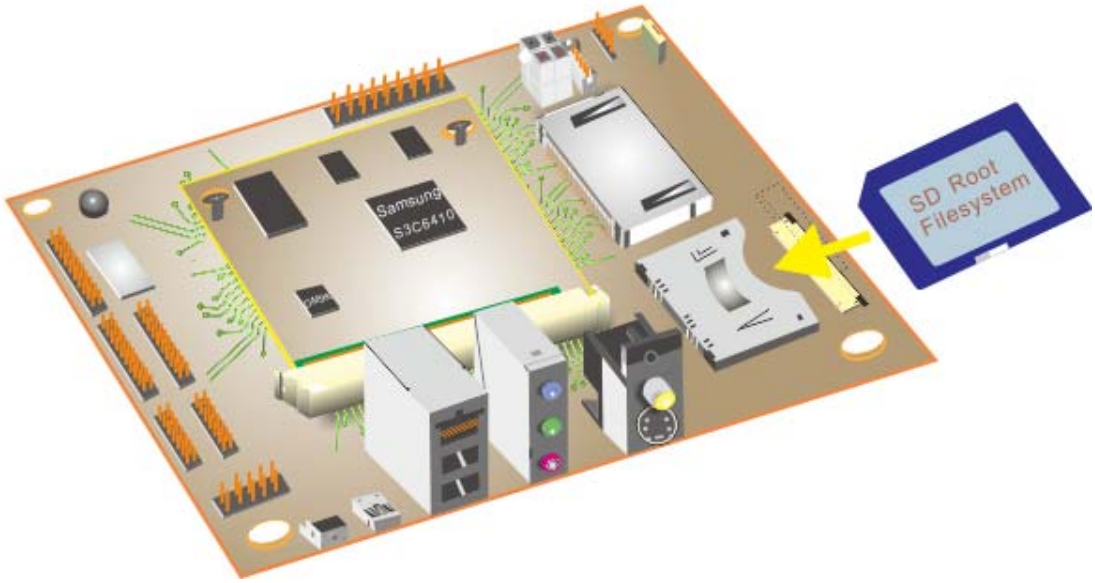
3.1 For Linux Users

Step 1：Extract Root Filesystem tarball to that SD/SDHC card

Figure 3.1 Extract Root FilesystemTarball to a SD/SDHC card

First of all, you need a Linux PC and extract the Ubuntu 9.04 rootfs into that SD/SDHC card. 2GB is minimal requirement for the Ubuntu 9.04 that released from Embedian. After done, plug the SD/SDHC card into CN24 (SD/SDHC socket) connector.

Figure 3.2 Plug the rootfs pre-installed SD/SDHC card into SBC



Details in regarding to how to make a pre-loaded file system CF card can be found at section 5.2.

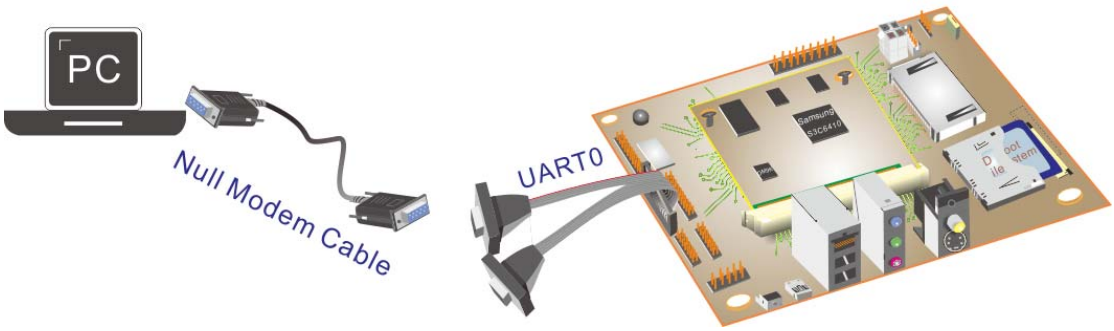
Step 2: Check Jumper Location of the evaluation kit

Different configurations can be set by several jumper blocks on board. For example, if you attached an LCD, JP2 needs to be shunt depending on your LCD is 5V or 3.3V. JP5 is to determine if the backlight power is 5V or 12V. If 5V is shunt, the power source is from pin3 of CN8. If 12V is shunt, the power source will be pin2 of CH8.

Step 3: Connect the DUART Console Debug Cable from SBC to a null modem cable and connect that null modem cable to your PC.

Use Embedian DUART console cable and connect from CN20 of SBC to a female-end null modem cable (TX/RX crossed) and connect that null modem cable to the COM port of your PC. Open the Hyperterminal program of your PC and set the baud rate as ***115200, 8N1***.

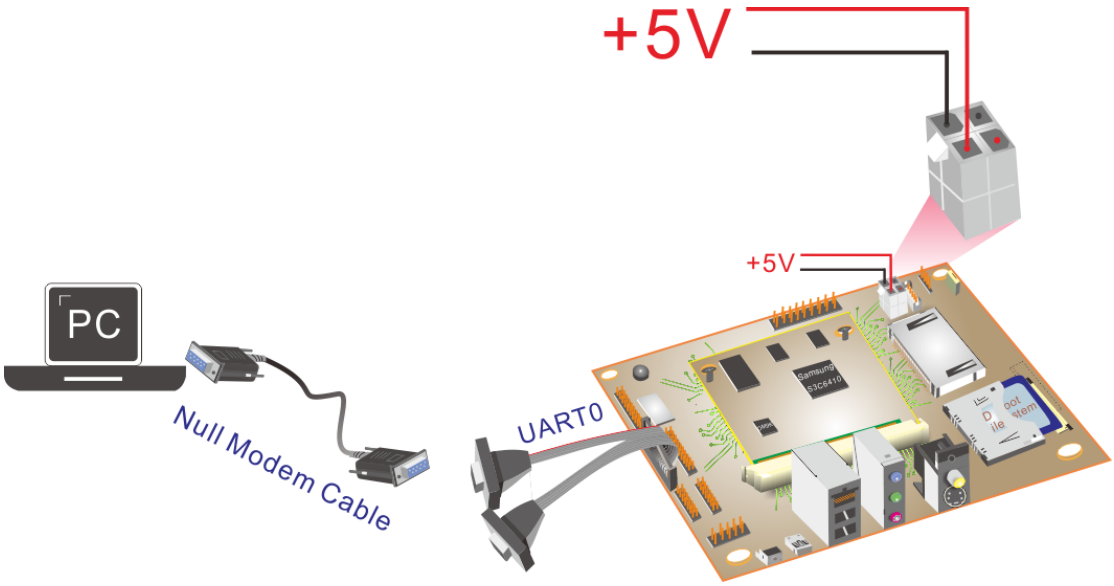
Figure 3.3 Connect DUART Console Debug Cable to a Null Modem Cable and to your PC



Step 4: Apply 5V to SBC

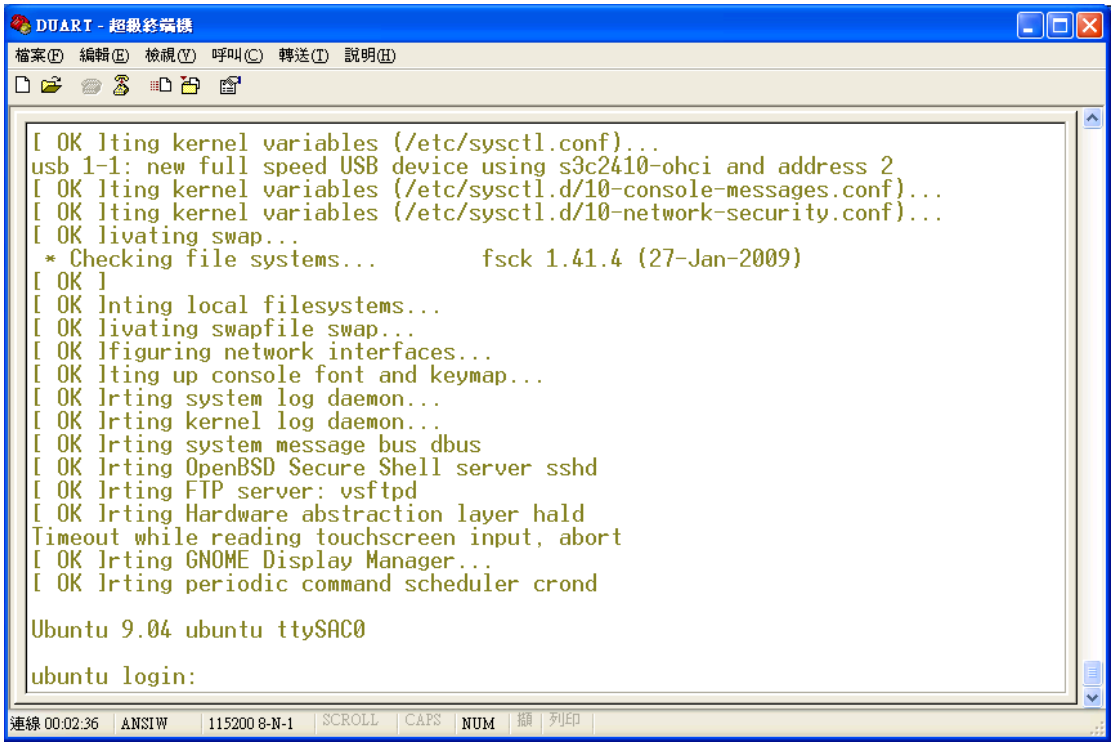
Apply DC 5V to SBC as shown in figure 3.4, the device will be power up.

Figure 3.4 Apply 5V DC to SBC



You will see the boot messages from the Hyperterminal as shown in figure 3.5.

Figure 3.5 Boot up messages from Hyperterminal


DUART - 超級終端機
檔案(F) 編輯(E) 檢視(V) 呼叫(C) 轉送(T) 說明(H)
[OK]ting kernel variables (/etc/sysctl.conf)...
usb 1-1: new full speed USB device using s3c2410-ohci and address 2
[OK]ting kernel variables (/etc/sysctl.d/10-console-messages.conf)...
[OK]ting kernel variables (/etc/sysctl.d/10-network-security.conf)...
[OK]ivating swap...
* Checking file systems... fsck 1.41.4 (27-Jan-2009)
[OK]
[OK]nting local filesystems...
[OK]ivating swapfile swap...
[OK]figuring network interfaces...
[OK]ting up console font and keymap...
[OK]rting system log daemon...
[OK]rting kernel log daemon...
[OK]rting system message bus dbus
[OK]rting OpenBSD Secure Shell server sshd
[OK]rting FTP server: vsftpd
[OK]rting Hardware abstraction layer hald
Timeout while reading touchscreen input, abort
[OK]rting GNOME Display Manager...
[OK]rting periodic command scheduler crond
Ubuntu 9.04 ubuntu ttySAC0
ubuntu login:
連線 00:02:36
ANSIW
115200 8-N-1
SCROLL
CAPS
NUM
擷
列印

The default root password is "***mxm6410***" (no quot). You can use ***passwd*** command to change the root password. The default "ubuntu" user password is also "***mxm6410***" (no quot).

Step 5: Network Configuration

Plug an Ethernet cable to CN17 of your device first.
The default network is set as DHCP. User can use *ifconfig eth0* command to check the device IP address.

```
ubuntu@ubuntu:~$ ifconfig eth0
eth0      Link encap:Ethernet  HWaddr 10:0d:32:10:01:12
```

```
          inet addr:192.168.1.121  Bcast:192.168.1.255
Mask:255.255.255.0
          UP BROADCAST RUNNING MULTICAST  MTU:1500  Metric:1
          RX packets:95 errors:0 dropped:0 overruns:0 frame:0
          TX packets:3 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:12326 (12.3 KB)  TX bytes:158 (158.0 B)
          Interrupt:72 Base address:0xe300

ubuntu@ubuntu:~$
```

Users can use ***ifconfig*** to change the IP address at runtime.

Example:

Below is an example to change the IP address to 192.168.1.122 and netmask to 255.255.255.0 at runtime.

```
ubuntu@ubuntu:~$ sudo ifconfig eth0 192.168.1.122 netmask 255.255.255.0
up
ubuntu@ubuntu:~$
```

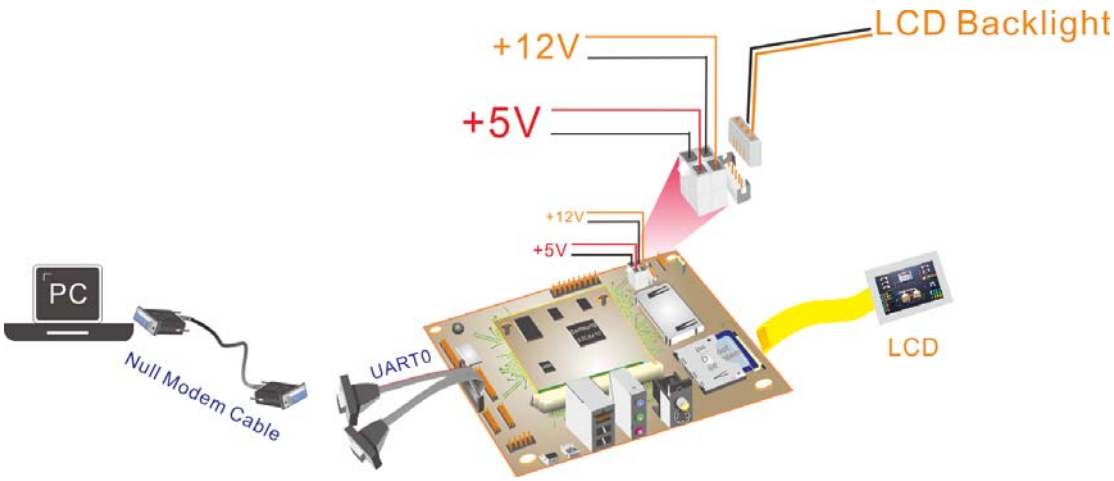
Note:

Every MAC address on board will be mapping to Embedian's serial number and is compliant to ISO/IEC 8802 standards. The MAC address is written on EEPROM of the board at factory and Linux kernel driver will read it automatically. There is no way that users can change it from root file systems.

Step 6: LCD

If you need to connect an LCD, use a FPC cable or LVDS cable (depending on the type of LCD) connect to SBC first. Check if JP2 and JP4 are configured properly. The FPC cable at the board side (CN14) is **top-contacted**. You will need to power the backlight yourself. The LCD backlight jumper block JP4 can be set to determine if the pin 1 of CN9 is bypassed from pin 3 of CN8 (5V) or pin2 of CN8 (12V). APC-6410 provides users with a 5V or 12V bypass path from pin 2 or pin 3 of CN8 to pin 1 of CN9 for the backlight connection.
Figure 6 shows the LCD connection.

Figure 3.6 LCD Connection



The device descriptor of the LCD is */dev/fb0*. The default LCD output will be Ubuntu gdm login screen.
The LCD driver is default built in the kernel instead of driver module.
If your LCD panel is in different resolutions other than 800x480, users also need to use *fbset* command to set up the frame buffer first. You need to *apt-get install fbset* package and fbset the framebuffer as follows.

```
root@ubuntu:/etc/apt# sudo apt-get install fbset
Reading package lists... Done
Building dependency tree
Reading state information... Done
The following NEW packages will be installed:
  fbset
0 upgraded, 1 newly installed, 0 to remove and 14 not upgraded.
```

```
Need to get 115kB of archives.
After this operation, 365kB of additional disk space will be used.
Get:1 http://old-releases.ubuntu.com jaunty/main fbset 2.1-23 [115kB]
Fetched 115kB in 2s (50.6kB/s)
Selecting previously deselected package fbset.
(Reading database ... 34128 files and directories currently installed.)
Unpacking fbset (from .../fbset_2.1-23_armel.deb) ...
Setting up fbset (2.1-23) ...

ubuntu@ubuntu:/etc/apt# fbset 800x480-0
ubuntu@ubuntu:/etc/apt#
```

The settings are located in the file ***/etc/fb.modes***. Different LCDs have different settings. You can add your own LCD settings into this file and fbset it.

3.2 For Wondows CE 6.0 Users

The APC-6410 has a number of jumpers that allow you to configure your system to suit your application. All use 2mm shorting blocks (shunts) to select settings.

Step 1: Check Jumper Location of the evaluation kit

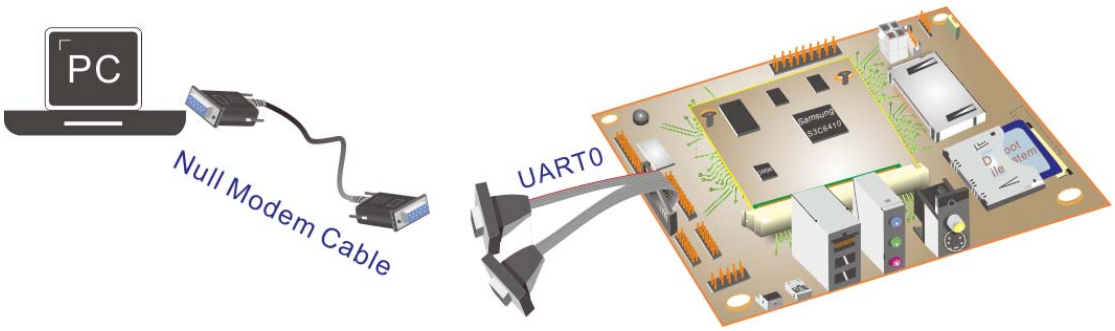
Different configurations can be set by several jumper blocks on board. For example, if you attached an LCD, JP2 needs to be shunt depending on your LCD is 5V or 3.3V. JP5 is to determine if the backlight power is 5V or 12V. If 5V is shunt, the power source is from pin3 of CN8. If 12V is shunt, the power source will be pin2 of CN8.

Step 2: Connect the DUART Console Debug Cable from SBC to a null modem cable and connect that null modem cable to your PC.

Use Embedian DUART console cable and connect from CN20 of SBC to a female-end null modem cable (TX/RX crossed) and connect that null modem

cable to the COM port of your PC. Open the Hyperterminal program of your PC and set the baud rate as ***115200, 8N1***.

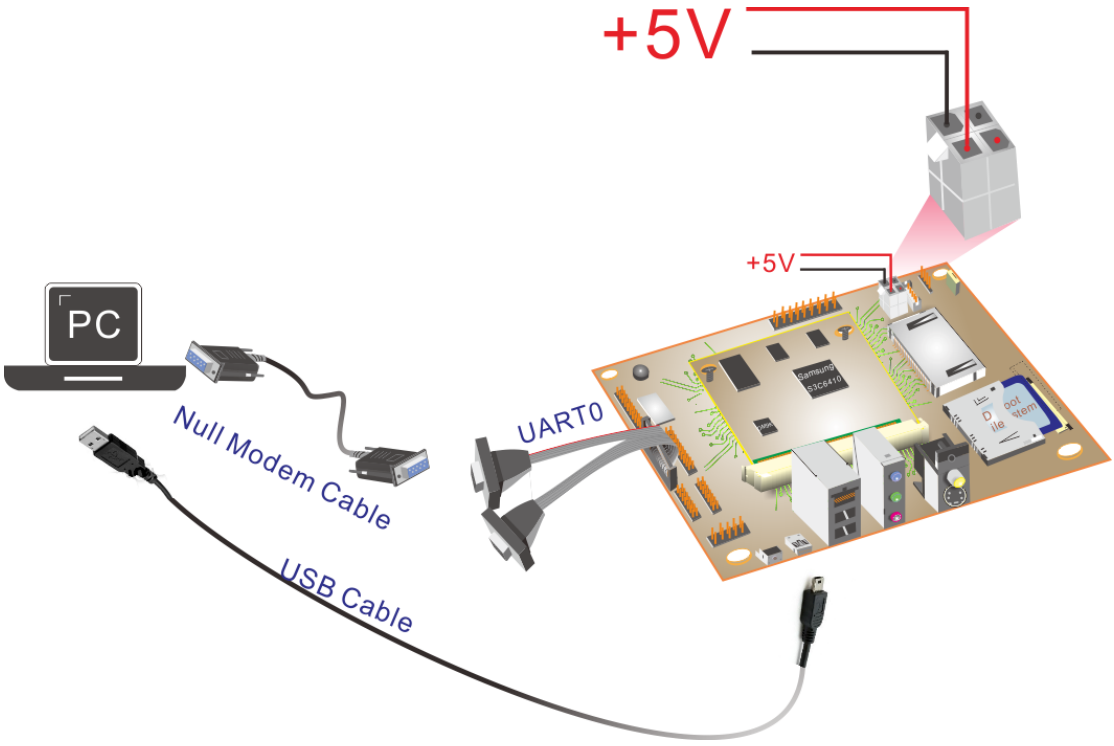
Figure 3.7 Connect DUART Console Debug Cable to a Null Modem Cable and to your PC



Step 4: Connect USB Cable from SBC to your PC and Apply 5V to SBC

Using a USB cable and connect the USB client port of SBC (CN19) to the host port of your PC first. Apply DC 5V to SBC as shown in figure 3.8, the device will be power up.

Figure 3.8 Connect USB Cable from SBC to your PC and Apply 5V DC to SBC



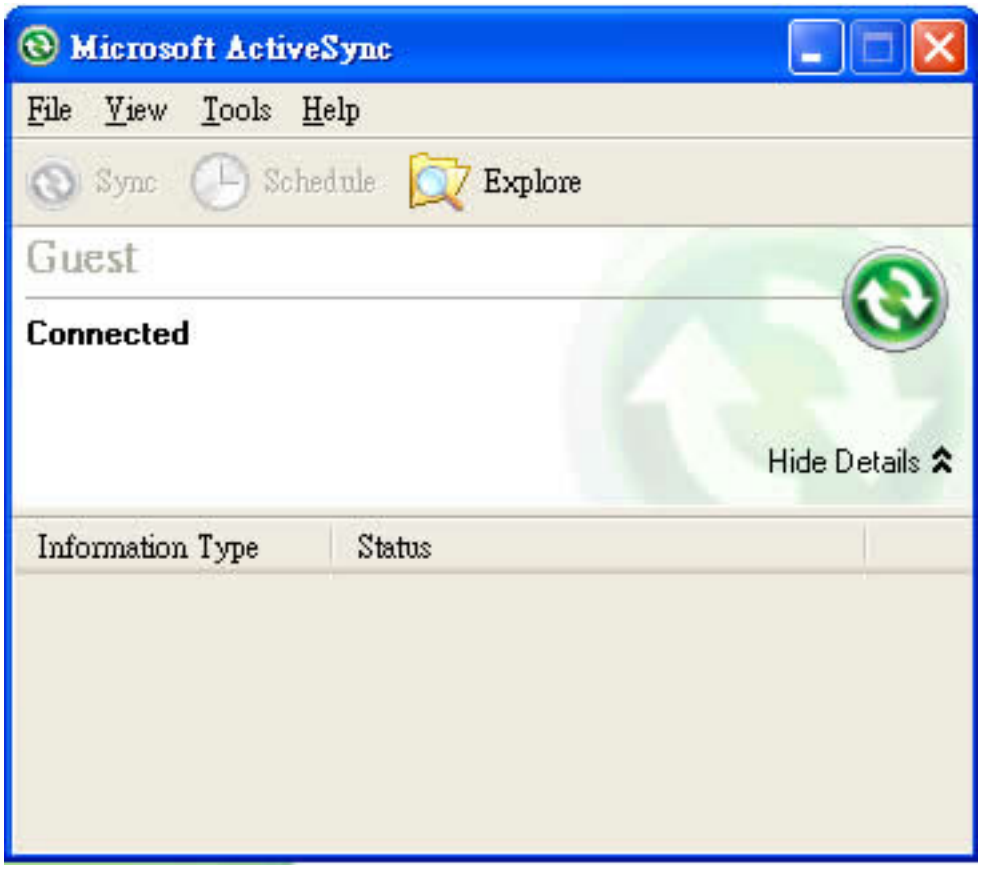
If you have ActiveSync program (user can download this program for free from Microsoft's website) installed in your Windows PC and the USB cable is connected to the device, you should be able to see the ActiveSync program pop out and ask you to set up a partnership during loading the NK image as shown in figure 3.9.

Figure 3.9 ActiveSync Program

New Partnership
Set Up a Partnership
Before you can synchronize information between your mobile device and this computer, you must set up a partnership between them.
Would you like to set up a partnership?
Yes
Set up a partnership so that I can synchronize information between my device and this computer.
No
I don't want to synchronize information. Set up my device as a guest so that I can copy or move information between my device and this computer.
< 上一步(B)
下一步(N) >
取消
說明

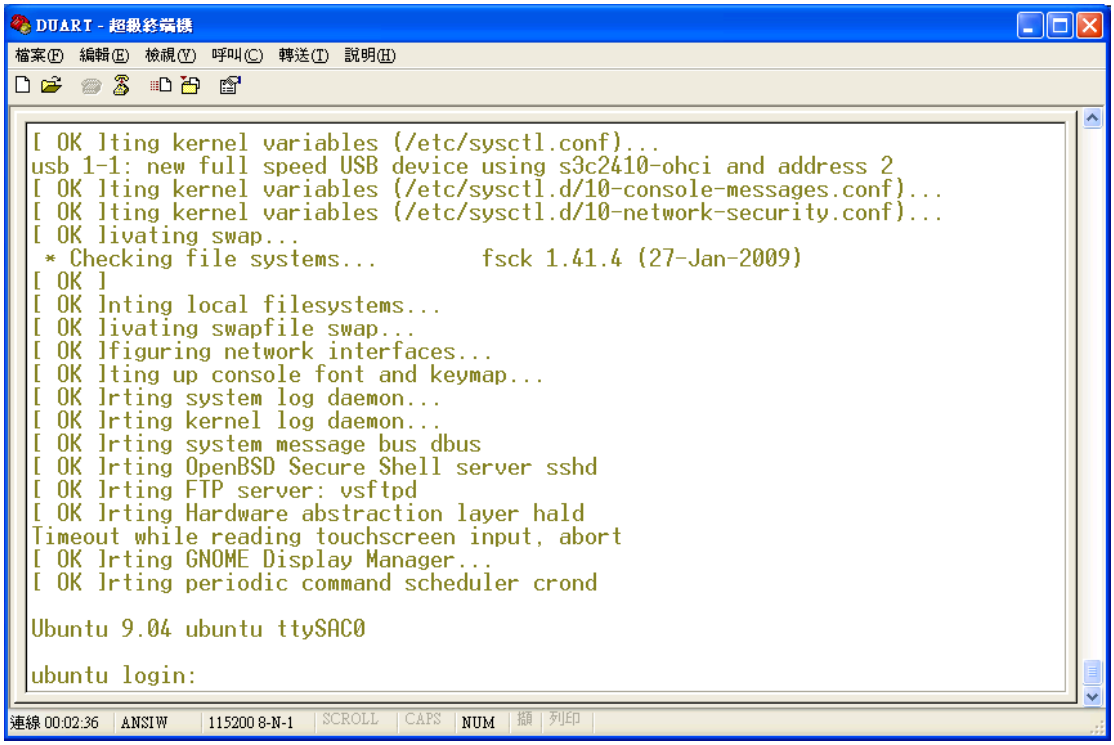
Select "**No**" and click "**Next**" of your ActiveSync program. You will see the screen shown as in figure 3.10.

Figure 3.10 ActiveSync Program



You will see the boot messages from the Hyperterminal as shown in figure 3.11.

Figure 3.11 Boot up messages from Hyperterminal


DUART - 超級終端機
檔案(F) 編輯(E) 檢視(V) 呼叫(C) 轉送(T) 說明(H)
[OK]ting kernel variables (/etc/sysctl.conf)...
usb 1-1: new full speed USB device using s3c2410-ohci and address 2
[OK]ting kernel variables (/etc/sysctl.d/10-console-messages.conf)...
[OK]ting kernel variables (/etc/sysctl.d/10-network-security.conf)...
[OK]ivating swap...
* Checking file systems... fsck 1.41.4 (27-Jan-2009)
[OK]
[OK]nting local filesystems...
[OK]ivating swapfile swap...
[OK]figuring network interfaces...
[OK]ting up console font and keymap...
[OK]rting system log daemon...
[OK]rting kernel log daemon...
[OK]rting system message bus dbus
[OK]rting OpenBSD Secure Shell server sshd
[OK]rting FTP server: vsftpd
[OK]rting Hardware abstraction layer hald
Timeout while reading touchscreen input, abort
[OK]rting GNOME Display Manager...
[OK]rting periodic command scheduler crond
Ubuntu 9.04 ubuntu ttySAC0
ubuntu login:
連線 00:02:36
ANSIW
115200 8-N-1
SCROLL
CAPS
NUM
擷
列印

Step 5: Network Configuration

Plug an Ethernet cable to CN17 of your device first.
The default network is set as DHCP. User can use *ifconfig eth0* command to check the device IP address.

```
ubuntu@ubuntu:~$ ifconfig eth0
eth0      Link encap:Ethernet  HWaddr 10:0d:32:10:01:12
          inet addr:192.168.1.121  Bcast:192.168.1.255
Mask:255.255.255.0
          UP BROADCAST RUNNING MULTICAST  MTU:1500  Metric:1
```

```
          RX packets:95 errors:0 dropped:0 overruns:0 frame:0
          TX packets:3 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:12326 (12.3 KB)  TX bytes:158 (158.0 B)
          Interrupt:72 Base address:0xe300

ubuntu@ubuntu:~$
```

Users can use ***ifconfig*** to change the IP address at runtime.

Example:

Below is an example to change the IP address to 192.168.1.122 and netmask to 255.255.255.0 at runtime.

```
ubuntu@ubuntu:~$ sudo ifconfig eth0 192.168.1.122 netmask 255.255.255.0
up
ubuntu@ubuntu:~$
```

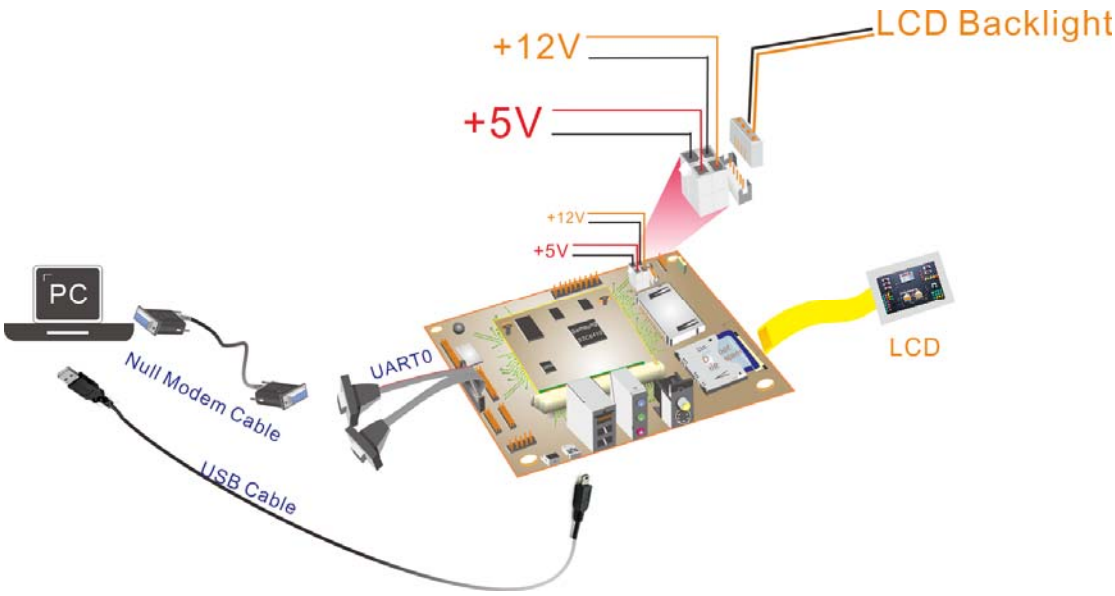
Note:

Every MAC address on board will be mapping to Embedian's serial number and is compliant to ISO/IEC 8802 standards. The MAC address is written on EEPROM of the board at factory and Linux kernel driver will read it automatically. There is no way that users can change it from root file systems.

Step 6: LCD

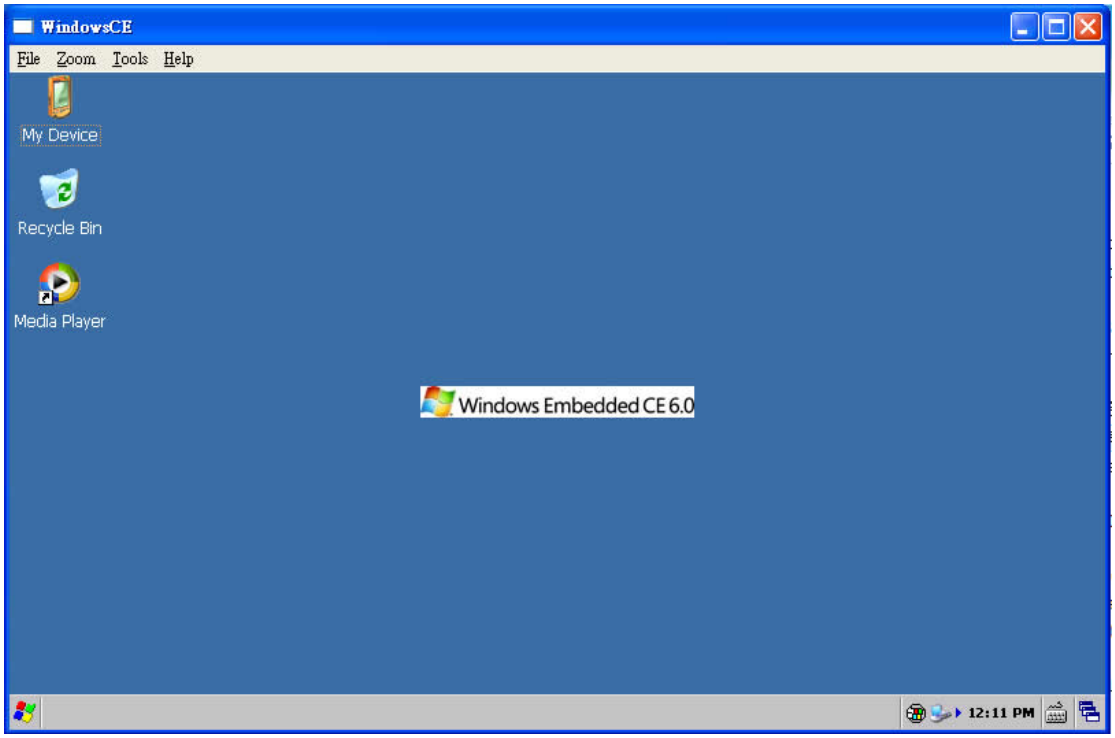
If you need to connect an LCD, use a FPC cable or LVDS cable (depending on the type of LCD) connect to SBC first. Check if JP2 and JP4 are configured properly. The FPC cable at the board side (CN14) is **top-contacted**. You will need to power the backlight yourself. The LCD backlight jumper block JP4 can be set to determine if the pin 1 of CN9 is bypassed from pin 3 of CN8 (5V) or pin2 of CN8 (12V). APC-6410 provides users with a 5V or 12V bypass path from pin 2 or pin 3 of CN8 to pin 1 of CN9 for the backlight connection.
Figure 6 shows the LCD connection.

Figure 3.12 LCD Connection



Users should be able to see the Windows CE 6.0 desktop on the LCD screen or remote tools as shown in figure 3.13.

Figure 3.13 Windows CE 6.0 Desktop



Hardware References

This Chapter contains detailed and specialized hardware information.

Chapter 4 Hardware References

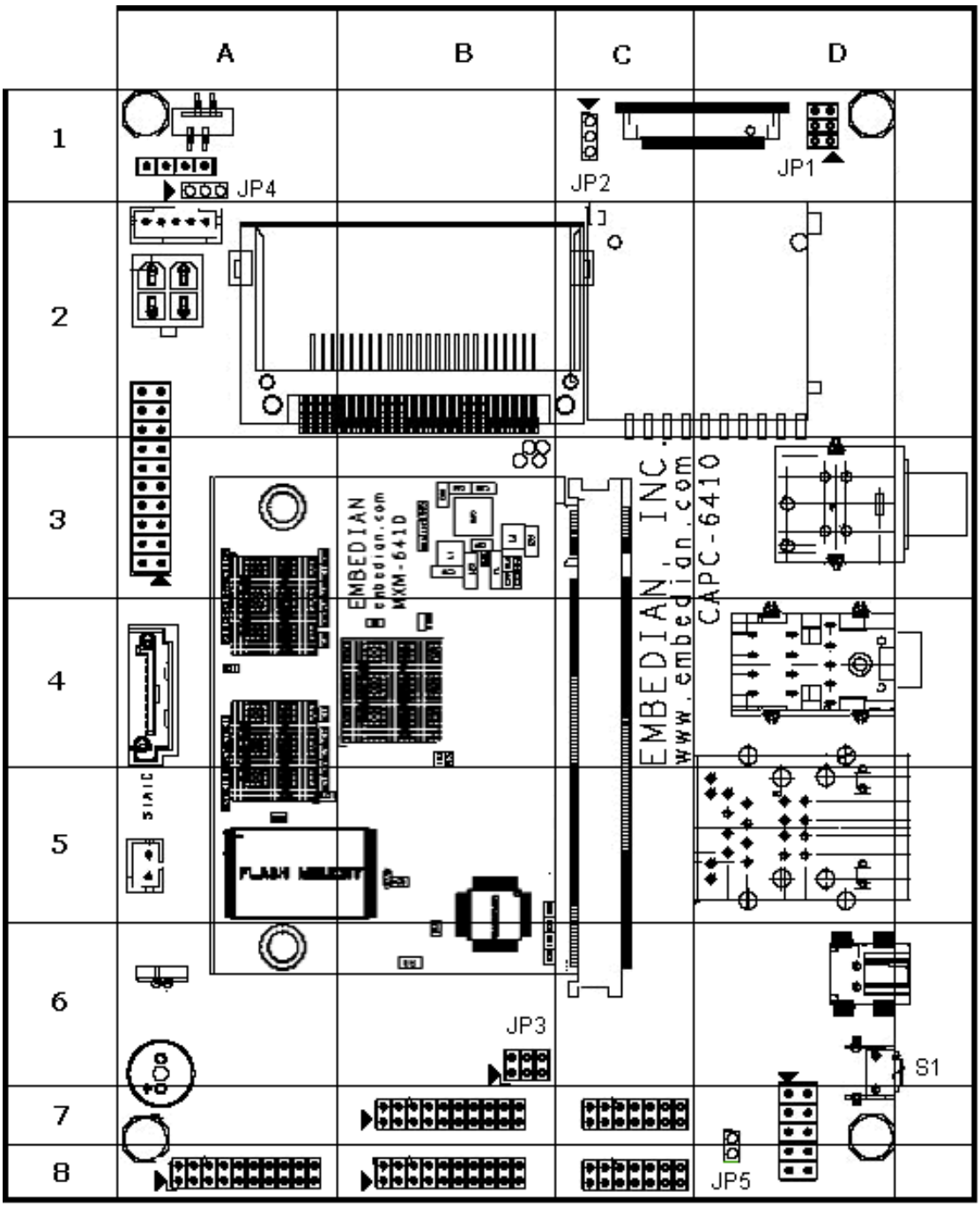
This section gives details of the hardware features of the APC-6410. These include a description of the switches, jumper settings, connectors and connector pin outs.

4.1 Jumpers

The APC-6410 has a number of jumpers that allow you to configure your system to suit your application. All use 2mm shorting blocks (shunts) to select settings. Turn off power to the APC-6410 before changing the position of a shunt.

4.1.1. Jumper Locations

Figure 4.1



4.1.2. List of Jumpers

The table below lists the function of various jumpers.

Table 4.1 Jumpers

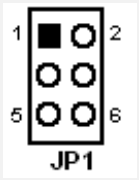
Table 4.1:	Jumpers
Label	**Function**
JP1	*NOR BOOT/NAND BOOT Selection*
JP2	*LCD Power Setting (From CPU LVDS and TTL)*
JP3	*RS232/422/485 Setting*
JP4	*5V/12V LCD Backlight Selection*
JP5	*SD Boot*
S1	*Reset Button*

4.1.3. Jumper Settings

The following tables describe how the jumper shunts to various configurations.

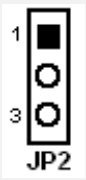
JP1: *Location on Board, D1*

Table 4.2 NOR Flash and NAND Flash Setting (JP1)

Table 4.2:	***NOR Flash and NAND Flash Setting (JP1)***	
	**Setting**	**Function**
	JP1(1-2)(Default)	*NOR Flash*
	N.C	*NAND Flash*

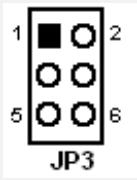
JP2: *Location on Board, C1*

Table 4.3 LCD VCC Power Setting for CN14 and CN15 (JP2) (from LVDS and TTL)

Table 4.3:	***LCD VCC Power Setting for CN14 and CN16 (JP2)(from LVDS and TTL)***	
	**Setting**	**Function**
	JP2(1-2)(Default)	*3.3V*
	JP2(2-3)	*5V*

JP3: *Location on Board, B6*

Table 4.4 RS232/422/485 Mode Setting

Table 4.4:	***RS232/422/485 Mode Setting***	
	**Setting**	**Function**
	JP3(1-2)(Default)	*RS232*
	JP3(3-4)	*RS422/RS485 half duplex*
	JP3(5-6)	*RS422/RS485 full duplex*

JP4: *Location on Board, A1*

Table 4.5 LCD Backlight Bypass Voltage

Table 4.5:	***LCD Backlight Bypass Voltage***	
	Setting	**Function**
	JP4(1-2)	*pin 1 of CN9 bypassed from pin 3 of CN8 is 5V*
	JP4(2-3)	*pin 1 of CN9 bypassed from pin 3 of CN8 is 12V*

JP5: *Location on Board, D7/D8*

Table 4.6 SD Boot Up

Table 4.6:	***SD Boot Up***	
	Setting	**Function**
	JP5(1-2)	*Boot from SD*
	N.C.	*Boot from NAND*

S1: *Location on Board, D6*

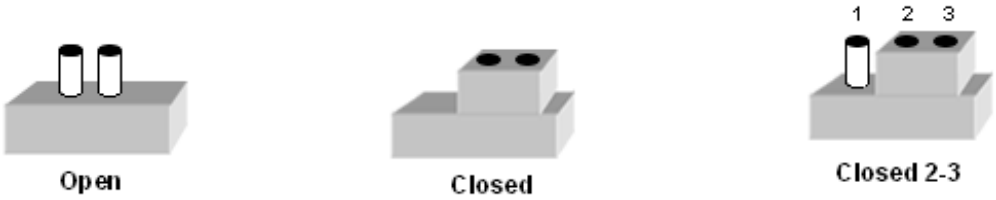
Table 4.7 Reset button

Table 4.7:	***Reset***	
	Setting	**Function**
	Press Button and Release Immediately	*Reset CPU and IO*

4.1.4. Setting Jumpers

You configure your board to match the needs of your application by setting jumpers. A jumper is the simplest kind of electric switch. It consists of two metal pins and a small metal clip (often protected by a plastic cover) that slides over the pins to connect them. To “close” a jumper you connect the pins with the clip.

To “open” a jumper you remove the clip. Sometimes a jumper will have three pins, labeled 1, 2 and 3. In this case you would connect either pins 1 and 2 or 2 and 3.



The jumper settings are schematically depicted in this manual as follows.

A pair of needle-nose pliers may be helpful when working with jumpers. If you have any doubts about the best hardware configuration for your application, contact your local distributor or sales representative before you make any change.

Generally, you simply need a standard cable to make most connections.

4.2 Connectors

Onboard connectors link the APC-6410 to external devices such as LCD panel, a keyboard, an audio headset or CompactFlash and to external communication such as 802.11, USB or Ethernet link. The table below lists the function of each of the board's connectors.

4.2.1. Connector Location

Figure 4.2 Top Side of Connector Locations

Top Side

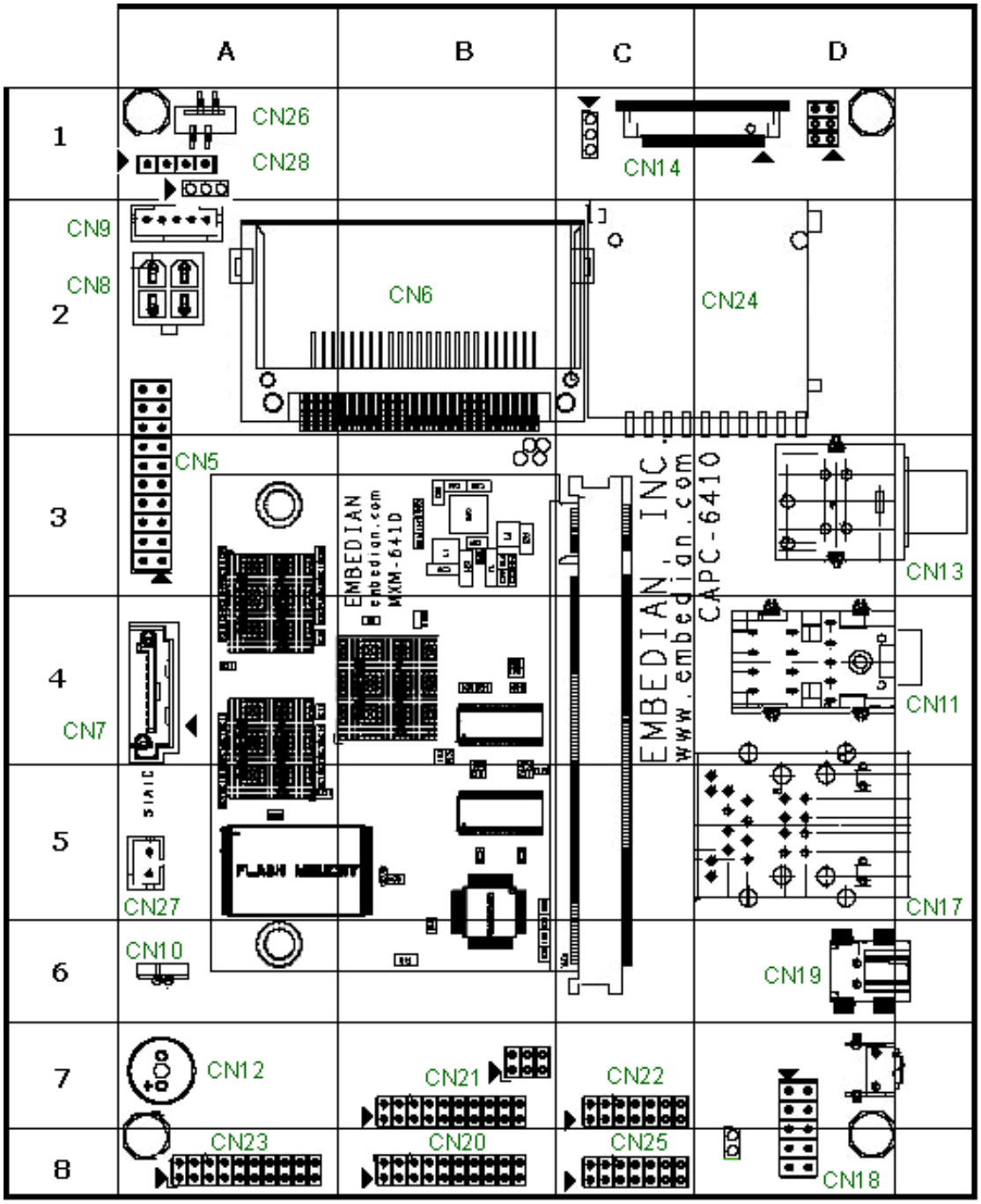
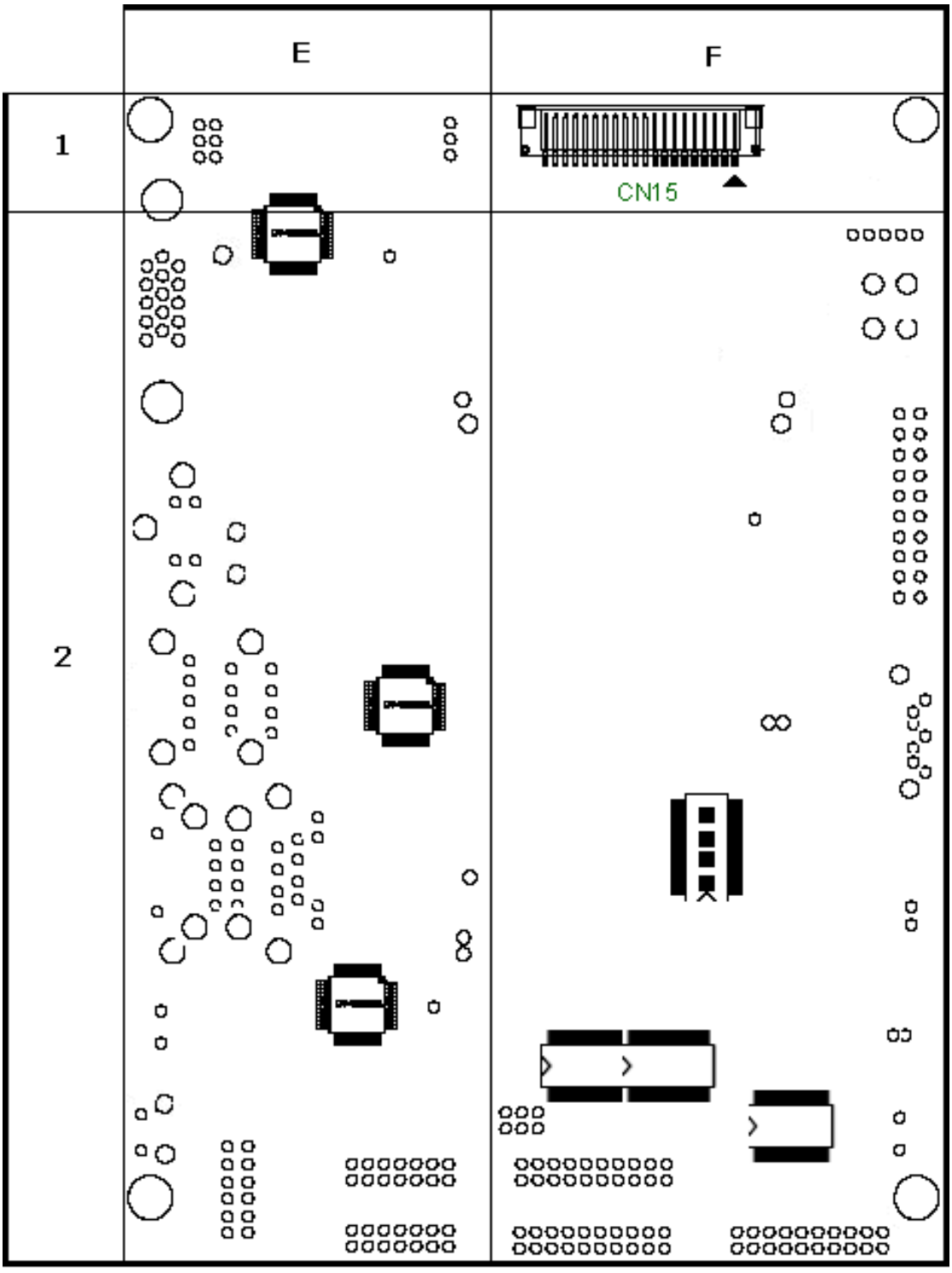


Figure 4.3 Bottom Side of Connection Locations

Bottom Side



4.2.2. List of Connectors

The table below lists the functions of the various connectors.

Table 4.8 List of Connectors

Table 4.8	***Connector***
Label	***Function***
CN5	*JTAG*
CN6	*CF Type I/II Connector*
CN8	*Power Connector*
CN9	*LCD Backlight Inverter Connector*
CN10	*RTC Battery Connector*
CN11	*Audio (Microphone in, Headphone out, Line in) Connector*
CN12	*Buzzer*
CN13	*S-Video and CVBS Video Connector*
CN14	*TTL Level LCD FPC Connector*
CN15	*LVDS LCD Connector*
CN16	*VGA DSub-15 Connector*
CN17	*Ethernet RJ45 and Double USB Host Type A Connector*
CN18	*Double USB Host Header*
CN19	*USB OTG Type B Connector*
CN20	*UART 0 and UART 1 Header*
CN21	*UART 2 and UART 3 Header*
CN22	*SPI and RS422/485 Header*
CN23	*UART 4 and UART 5 Header*

CN24	*SD/SDHC Connector*
CN25	*GPIO Header*
CN26	*4-Wire Touch Panel Connector*
CN27	*CAN Bus Connector*
CN28	

4.2.3. Connector Pin Assignments

The following tables describe the electrical signals available on the connectors of the APC-6410. Each section provides relevant details about the connector including part numbers, mating connectors, signal descriptions and references to related chapters. For precision measurements of the location of the connectors on the APC-6410, refer to section 2.2.2. for mechanical drawing.

Legend：

NC	Not Connected
GND	APC-6410 Power Plane

Signal Types：

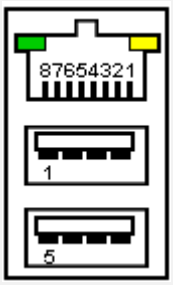
I	signal is an input to the system
O	signal is an output to the system
IO	signal may be input or output
P	power and ground
A	analog signal

4.2.3.1. Ethernet RJ45 and Double USB Host Type A Connector：CN17

Four onboard USB host interfaces are available through the double port header CN18 (9 pins) and CN17 (8pins). All USBs are OHCI Rev. 1.0 compliance. There is one Ethernet RJ45 connector in CN17 as well. The following table shows the pin outs of the Ethernet RJ45 and Double USB connector.

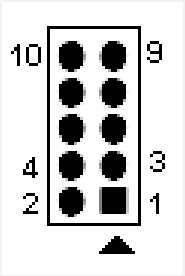
CN17：*Location on Board, D5*

Table 4.9 Ethernet RJ45 and Double USB Host Type A Connector

Table 4.9:	***Ethernet RJ45 and Double USB Host Type A Connector (CN17)***			
Description	***Ethernet RJ45 and Double USB Host Type A Connector***			
Header	***Pin***	***Signal Name***	***Function***	***Type***
	*1*	*USB1_5V **	*USB1 -supply (max. 500mA)*	*PO*
	2	*USB1-*	*Universal serial bus port 1 (-)*	*IO*
	3	*USB1+*	*Universal serial bus port 0 (+)*	*IO*
	4	*USB_GND*	*USB Ground*	*P*
	5	*USB2_5V **	*USB2 -supply (max. 500mA)*	*PO*
	6	*USB2-*	*Universal serial bus port 2 (-)*	*IO*
	7	*USB2+*	*Universal serial bus port 2 (+)*	*IO*
	8	*USB_GND*	*USB Ground*	*P*

CN14: *Location on Board, D7/D8*

Table 4.10 Double USB Header

Table 4.10:	***Double USB Connector (CN18)***			
Description	***USB Header***			
Header	***Pin***	***Signal Name***	***Function***	***Type***
	*1*	*USB3_5V **	*USB3 -supply (max. 500mA)*	*PO*
	2	*USB3_5V **	*USB3 -supply (max. 500mA)*	*PO*
	3	*USB3-*	*Universal serial bus port 3 (-)*	*IO*
	4	*USB4-*	*Universal serial bus port 4 (-)*	*IO*
	5	*USB3+*	*Universal serial bus port 3 (+)*	*IO*
	6	*USB4+*	*Universal serial bus port 4 (+)*	*IO*
	7	*USB_GND*	*USB Ground*	*P*
	8	*USB_GND*	*USB Ground*	*P*
	9	*Key*	*Key*	
	10	*NC*	*Not Connected*	

Note:

(*) To protect the external power lines of peripheral devices, make sure that:

-- The wires have the right diameter to withstand the maximum available current.

-- The enclosure of the peripheral device fulfills the fire-protecting requirements of IEC/EN 60950.

The USB power lines are protected with a resetable fuse and are limited to 500mA.

If the USB device is powered from the APC-6410 directly, not from the external power, make sure that the total power consumption does not exceed the DC power budget of APC-6410. For example, you might need to use a 5V/2A adapter instead of 5V/1A for APC-6410.

4.2.3.2. 10/100Mbps Ethernet Port： CN17

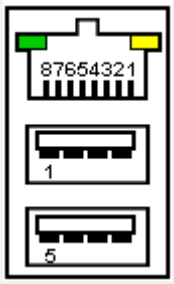
The APC-6410 on-board Ethernet interface uses the Davicom DM9000B integrated PHY. This combination supports a 10/100Base-T interface. The device auto-negotiates the use of a 10Mbit/sec or 100Mbit/sec connection.

The 10/100Base-T connector is a standard 8 -pin RJ45 jack (CN12) with integrated LEDs for link and speed. The link LED is blinking on activity.

The following table shows the pin-out of the Ethernet connector.

CN17：*Location on Board, D5*

Table 4.11 Ethernet RJ45 and Double USB Host Type A Connector

Table 4.11:	***Ethernet RJ45 and Double USB Host Type A Connector (CN17)***			
Description	***Ethernet RJ45 and Double USB Host Type A Connector***			
Header	***Pin***	***Signal Name***	***Function***	***Type***
	*1*	*TXD+*	*Transmit Data+*	*Differential Output*
	2	*TXD-*	*Transmit Data-*	*Differential Output*
	3	*RXD+*	*Receive Data+*	*Differential Input*
	4	*NC*	*Not Connected*	
	5	*NC*	*Not Connected*	
	6	*RXD-*	*Receive Data-*	*Differential Input*
	7	*NC*	*For internal use only*	
	8	*NC*	*For internal use only*	
	L	*Left LED*	*Duplex*	*Yellow*
	R	*Right LED*	*Link and Ack.*	*Green*
	USB Type A			
	Pin	***Signal Name***	***Function***	***Type***
	1	*USB1_5V **	*USB1 -supply (max. 500mA)*	*PO*
	2	*USB1-*	*Universal serial bus port 1 (-)*	*IO*

	3	*USB1+*	*Universal serial bus port 1 (+)*	*IO*
	4	*USB_GND*	*USB Ground*	*P*
	5	*USB2_5V **	*USB2 -supply (max. 500mA)*	*PO*
	6	*USB2-*	*Universal serial bus port 2 (-)*	*IO*
	7	*USB2+*	*Universal serial bus port 2 (+)*	*IO*
	2	*USB1-*	*Universal serial bus port 1 (-)*	*IO*

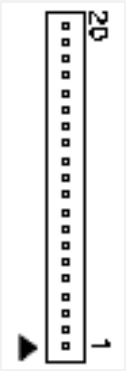
4.2.3.3. Graphic Interfaces: CN14, CN15

The APC-6410 use the graphic interface from CPU LCD controller and supports TTL level FPC type connector and LVDS connector. The recommend resolution is 800x600 or less.

The following table shows the pin-out of the graphic interface connector.

CN15：*Location on Board, F1*

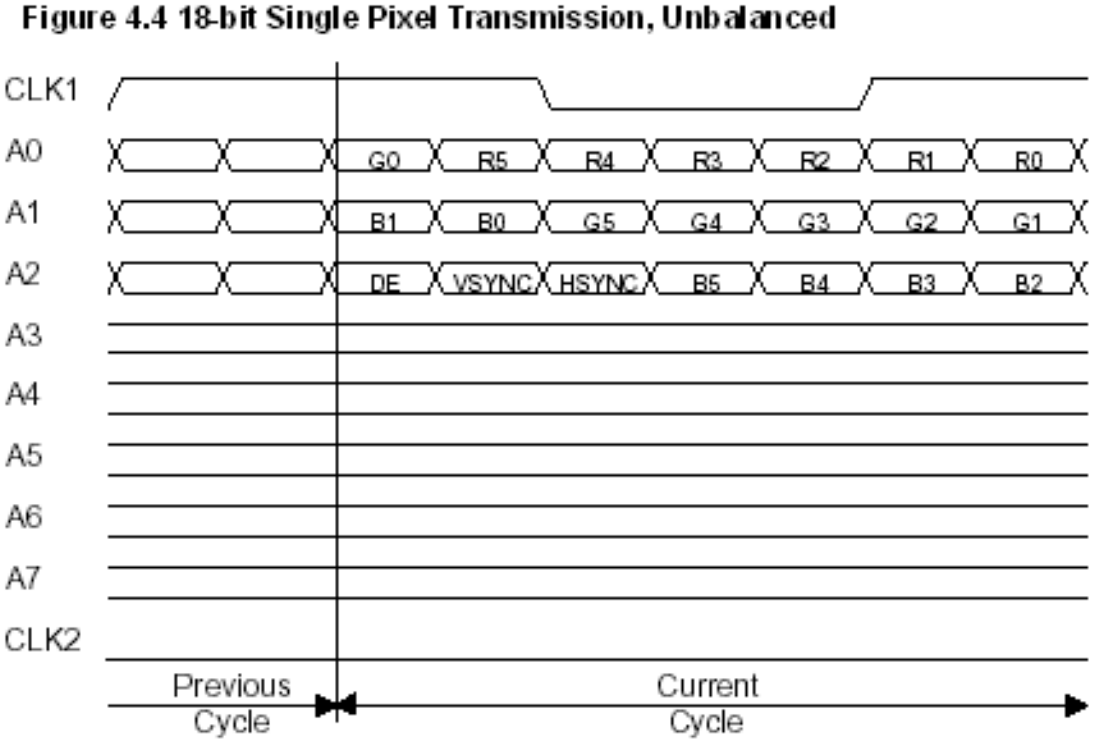
Table 4.12 LVDS Connector (From CPU LCD Controller)

Table 4.12:	***LVDS Connector (CN15) (From CPU LCD Controller)***	
Description	****CONN. DF14-20P-1.25H***	
Header	***Pin***	***Signal Name(*)***
	*1*	*GND*
	2	*GND*
	3	*NC*
	4	*NC*
	5	*GND*
	6	*CLKP*
	7	*CLKM*
	8	*GND*
	9	*A2P*
	10	*A2M*
	11	*GND*
	12	*A1P*
	13	*A1M*
	14	*GND*
	15	*A0P*
	16	*A0M*
	17	*GND*
	18	*GND*
	19	*VCC (3.3V or 5V)*
	20	*VCC (3.3V or 5V)*

Note：

(*) CN21 is the 18-bit LVDS signal from CPU LCD controller. In the 18-bit single pixel mode, the RGB and control inputs shall be transmitted as shown in Figure 4.4. Outputs A3 through A7 and CLK2 shall be inactive in this mode and fixed at a single value.

Figure 4.4 18-bit Single Pixel Transmission



1. The model number of the CN21 socket is DF14-20P-1.25H (Hirose Electric Co., Ltd.).
2. LCD and LVDS are shared the same LCD signals.

CN14: Location on board, C1/D1

Table 4.13 TTL Level Board-to-Wire Connector from CPU LCD

Table 4.13:	***CPU TTL Level FPC Connector (CN14)***		
Description	***33-pin FPC connector pitch 0.5mm***		
Header	***Pin***	***Signal Name***	***Function***
	1	*GND*	*Ground*
	2	*VCLK*	*Pixel Clock*
	3	*HSYNC*	*Horizontal Sync.*
	4	*VSYNC*	*Vertical Sync.*
	5	*GND*	*Ground*
	6	*R0*	*Red Data*
	7	*R1*	
	8	*R2*	
	9	*R3*	
	10	*R4*	
	11	*R5*	
	12	*GND*	*Ground*
	13	*G0*	*Green Data*
	14	*G1*	
	15	*G2*	
	16	*G3*	
	17	*G4*	
	18	*G5*	
	19	*GND*	*Ground*
	20	*B0*	*Blue Data*
	21	*B1*	
	22	*B2*	
	23	*B3*	
	24	*B4*	
	25	*B5*	
	26	*GND*	*Ground*
	27	*DE*	*Data Enable*
	28	*VCC*	*Power Supply*
	29	*VCC*	*Power Supply*
	30	*R/L*	*Horizontal Image Shift-direction Select Signal*

	31	*U/D*	*Vertical Image Shift-direction Select Signal*
	32	*N.C.*	*Not Connected*
	33	*N.C.*	*Not Connected*

Note：

1. The model number of the CN14 socket is 33-pin FPC connector pitch 0.5mm.
2. LCD and LVDS are shared the same LCD signals.

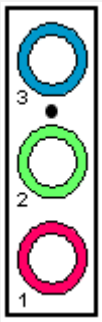
4.2.3.4. Audio Port：CN11

The APC-6410 uses the ALC203 AC97 Codec from the AC-link interface of CPU. The Audio port interface is a headset, microphone and line-in audio jack. The audio of APC-6410 is AC'97 2.3 compatible stereo audio CODEC, including host/soft audio, and AMR/CNR based designs. The codec could achieve a high SNR (greater than 100 dB), sensing logics for device reporting. The AC'97 CODEC supports multiple CODEC extensions with independent variable sampling rates and built-in 3D effects.

The following table shows the pin-out of the Audio connector.

CN11：*Location on Board, D4*

Table 4.14 Audio Headset Phone Connector

Table 4.14:	***Audio Connector (CN11)***			
Description	***3.5mm Audio Jack***			
Header	***Pin***	***Signal Name***	***Function***	***In/Out***
	*1*	*Mic. In*	*Microphone Input*	*I*
	2	*Audio Out*	*Headset Phone Output*	*O*
	3	*Line In*	*Line In*	*I*

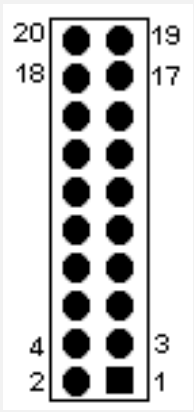
4.2.3.5. Serial Communication Port：CN20, CN21, CN22 and CN23

APC-6410 provides with one serial console port, one RS232/422/485 port, and five RS232 ports. The serial console port is available through a 2x10 header. (UART0 of CN20) The RS232/422/485 is available through CN22. (2x7-pin header) The five serial ports are available through the double port connector CN21 and CN23 (20-pin header) and CN20 (20-pin header).

The following table shows the pin-out of the serial connector.

CN20：*Location on Board, B8*

Table 4.15 Double RS232 Header, UART0 is the Console Port

Table 4.15:	***Double RS232 Header (CN20)***			
Description	***HEADER DIP 10*2P 180D MALE 2.0mm***			
Header	***Pin***	***Signal Name***	***Function***	***Type***
	*1*	*NC*	*Not Connected*	
	2	*NC*	*Not Connected*	
	3	*RXD0*	*Receive Data*	*I*
	4	*RTS0*	*Ready to Send*	*O*
	5	*TXD0*	*Transmit Data*	*O*
	6	*CTS0*	*Clear To Send*	*I*
	7	*NC*	*Not Connected*	
	8	*NC*	*Not Connected*	
	9	*GND1*	*Ground*	*P*
	10	*Shield*	*Ground Earth*	*P*
	11	*NC*	*Not Connected*	
	12	*NC*	*Not Connected*	
	13	*RXD1*	*Receive Data*	*I*
	14	*RTS1*	*Ready to Send*	*O*
	15	*TXD1*	*Transmit Data*	*O*
	16	*CTS1*	*Clear To Send*	*I*
	17	*NC*	*Not Connected*	
	18	*NC*	*Not Connected*	
	19	*GND2*	*Ground*	*P*
	20	*Shield*	*Ground Earth*	*P*

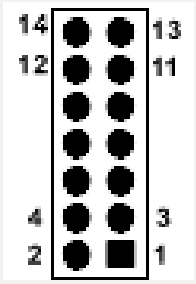
Note：

A 2x10 way header to two DSUB 9 way cable is available from Embedian.

UART0 also serve as console output.

CN22：*Location on Board, C7*

Table 4.16 SPI and RS232/422/485 Connector

Table 4.16:	***SPI and 422/485 Connector (CN22)***			
Description	***HEADER DIP 7*2P 180D MALE 2.0mm***			
Header	***Pin***	***RS422***		***RS485***
	*1*	*GND*		*GND*
	2	*Shield*		*Shield*
	3	*TXD+*		*TXD+*
	4	*TXD-*		*TXD-*
	5	*RXD+*		*RXD+*
	6	*RXD-*		*RXD-*
		Signal Name	***Function***	***Type***
	7	*SPIMISO0*	*Master mode: data input; Slave mode: data output*	*I/O*
	8	*SPIMISO1*	*Master mode: data input; Slave mode: data output*	*I/O*
	9	*SPIMOSI0*	*Master mode: data output; Slave mode: data input*	*I/O*
	10	*SPIMOSI1*	*Master mode: data output; Slave mode: data input*	*I/O*
	11	*SPICLK0*	*SPI Clock*	*I/O*
	12	*SPICLK1*	*SPI Clock*	*I/O*
	13	*nSS0*	*SPI Chip Select*	*I*
	14	*nSS1*	*SPI Chip Select*	*I*

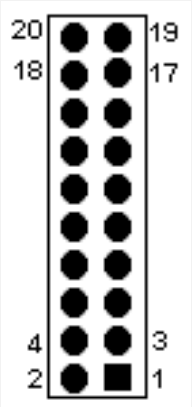
Note：

RS422/485 (pin 1~6 of CN22) share with UART1 (pin 11~20 of CN20, that means UART1 and RS422/485 cannot be used simultaneously.)

by the jumper settings of JP3.

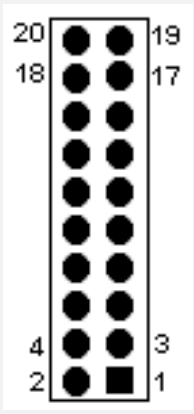
CN21：*Location on Board, B7*

Table 4.17 Double RS232 Connector

Table 4.17:	***Double RS232 Connector (CN21)***			
Description	***HEADER DIP 10*2P 180D MALE 2.0mm***			
Header	***Pin***	***Signal Name***	***Function***	***Type***
	*1*	*NC*	*Not Connected*	
	2	*NC*	*Not Connected*	
	3	*RXD2*	*Receive Data*	*I*
	4	*NC*	*Not Connected*	
	5	*TXD2*	*Transmit Data*	*O*
	6	*NC*	*Not Connected*	
	7	*NC*	*Not Connected*	
	8	*NC*	*Not Connected*	
	9	*GND2*	*Ground*	*P*
	10	*Shield*	*Ground Earth*	*P*
	11	*NC*	*Not Connected*	
	12	*NC*	*Not Connected*	
	13	*RXD3*	*Receive Data*	*I*
	14	*NC*	*Not Connected*	
	15	*TXD3*	*Transmit Data*	*O*
	16	*NC*	*Not Connected*	
	17	*NC*	*Not Connected*	
	18	*NC*	*Not Connected*	
	19	*GND3*	*Ground*	*P*
	20	*Shield*	*Ground Earth*	*P*

CN23：*Location on Board, A8*

Table 4.18 Double Full RS232 Connector

Table 4.18:	***Double Full Rs232 Connector (CN23)***			
Description	***HEADER DIP 10*2P 180D MALE 2.0mm***			
Header	***Pin***	***Signal Name***	***Function***	***Type***
	*1*	*DCD3*	*Data Carrier Detect*	*I*
	2	*DSR3*	*Data Set Ready*	*I*
	3	*RXD3*	*Receive Data*	*I*
	4	*RTS3*	*Ready to Send*	*O*
	5	*TXD3*	*Transmit Data*	*O*
	6	*CTS3*	*Clear To Send*	*I*
	7	*DTR3*	*Data Terminal Ready*	*O*
	8	*RI3*	*Ring Indicator*	*I*
	9	*GND3*	*Ground*	*P*
	10	*Shield*	*Ground Earth*	*P*
	11	*DCD4*	*Data Carrier Detect*	*I*
	12	*DSR4*	*Data Set Ready*	*I*
	13	*RXD4*	*Receive Data*	*I*
	14	*RTS4*	*Ready to Send*	*O*
	15	*TXD4*	*Transmit Data*	*O*
	16	*CTS4*	*Clear To Send*	*I*
	17	*DTR4*	*Data Terminal Ready*	*O*
	18	*RI4*	*Ring Indicator*	*I*
	19	*GND4*	*Ground*	*P*
	20	*Shield*	*Ground Earth*	*P*

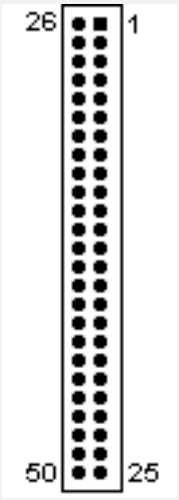
4.2.3.6. CompactFlash (CF) Socket：CN6

The CompactFlash socket CN6 (50 pins) for commercial CompactFlashes (Type I and II) is integrated on APC-6410 board. The interface is also a hot-plug capable interface.

The following table shows the pin-out of the CompactFlash socket.

CN6：*Location on Board, A2/B2*

Table 4.19 CompactFlash Connector

Table 4.19:	***CompactFlash Connector (CN6)***			
Description	***HEADER for CF typeII 50P 90D(M)SMD 3M W/O Ejector***			
Header	***Pin***	***Signal Name***	***Function***	***Type***
	*1*	*GND*	*Ground*	*P*
	2	*D3*	*Data 3*	*IO*
	3	*D4*	*Data 4*	*IO*
	4	*D5*	*Data 5*	*IO*
	5	*D6*	*Data 6*	*IO*
	6	*D7*	*Data 7*	*IO*
	7	*nCE1*	*High Byte Chip Select*	*O*
	8	*A10*	*Address 10*	*O*
	9	*nOE*	*Memory Read*	*O*
	10	*A9*	*Address 9*	*O*
	11	*A8*	*Address 8*	*O*
	12	*A7*	*Address 7*	*O*
	13	*VCC*	*External Switched CardB Power Input*	*PI*
	14	*A6*	*Address 6*	*O*
	15	*A5*	*Address 5*	*O*
	16	*A4*	*Address 4*	*O*
	17	*A3*	*Address 3*	*O*
	18	*A2*	*Address 2*	*O*
	19	*A1*	*Address 1*	*O*
	20	*A0*	*Address 0*	*O*
	21	*D0*	*Data 0*	*IO*
	22	*D1*	*Data 1*	*IO*
	23	*D2*	*Data 2*	*IO*
	24	*WP_nIOIS16*	*16 Bit Access*	*I*

	25	nCD2	Card Detect 2	I
	26	nCD1	Card Detect 1	I
	27	D11	Data 11	IO
	28	D12	Data 12	IO
	29	D13	Data 13	IO
	30	D14	Data 14	IO
	31	D15	Data 15	IO
	32	nCE2	Low Byte Chip Select	O
	33	nVS1	Voltage Sense 1 Input	I
	34	nIORD	IO Read	O
	35	nIOWR	IO Write	O
	36	nWE(nMWR)	Memory Write	I
	37	Ready_nIRQ	Interrupt Signal	P
	38	VCC	Card Power	I
	39	nCARDSEL	Card Select	O
	40	nVS2	Voltage Sense 2 Input	I
	41	CF_RESET	Reset	I
	42	nWait_CF	Wait	I
	43	nINPACK	Interrupt Acknowledge	I
	44	nREQ	Register Access	O
	45	BVD2_nSPKR	Speaker Input	IO
	46	BVD1_nSTSCHG	Status Change	IO
	47	D8	Data 8	IO
	48	D9	Data 9	IO
	49	D10	Data 10	IO
	50	GND	Ground	P

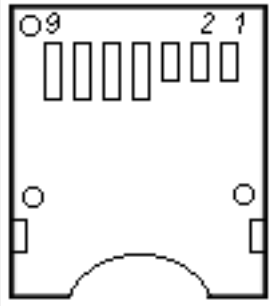
4.2.3.7.SD/SDHC Socket：CN24

The SD/SDHC socket CN24 (50 pins) for commercial SD/SDHC card is integrated on APC-6410 board. The interface is also a hot-plug capable interface.

The following table shows the pin-out of the SD/SDHC socket.

CN6：*Location on Board, A2/B2*

Table 4.20 SD/SDHC Connector

Table 4.20:	***SD/SDHC Connector (CN24)***			
Description	***SD Connector***			
Header	***Pin***	***Signal Name***	***Function***	***Type***
	*1*	*CD/DAT3*	*SD Insert Detect/ SD receive/transmit data*	*I/IO*
	2	*DAT2*	*SD receive/transmit data*	*IO*
	3	*CMD*	*SD receive response/ transmit command*	*O*
	4	*GND*	*Ground*	*P*
	5	*VDD*	*Power*	*P*
	6	*CLK*	*SD Clock*	*I*
	7	*GND*	*Ground*	*P*
	8	*DAT0*	*SD receive/transmit data*	*I/O*
	9	*DAT1*	*SD receive/transmit data*	*I/O*

Note：

Maximum SDHC card capacity is 32GB.

4.2.3.8. LCD Backlight Inverter Connector：CN9

The following table shows the pin outs of the LCD backlight inverter connector.

CN9：*Location on Board, A2*

Table 4.21 LCD Backlight Inverter Connector

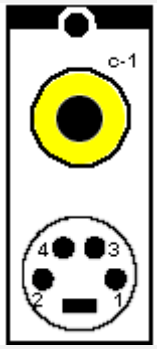
Table 4.21:	***LCD Backlight Inverter Connector (CN9)***			
Description	***WAFER BOX 2.0mm 5P 180D MALE W/LOCK***			
Header	***Pin***	***Signal Name***	***Function***	***Type***
	1	*EXT 5V/12V*	*Power supply for backlight inverter (depend on settings in JP4)*	*PO*
	2	*GND*	*Ground*	*P*
	3	*Enable*	*On/off control for backlight inverter*	*O*
	4	*PWM1*	*Brightness control for backlight inverter*	*IO*
	5	*PWM2*		*IO*

4.2.3.9. TV-Out, S-Video and RCA JACK: CN13

The following table shows the pin outs of the TV-Out connector.

CN13：*Location on Board, D3*

Table 4.22 TV-Out Connector

Table 4.22:	***TV-Out Connector (C13)***			
Description	***S-Video and RCA Jack***			
Header	***Pin***	***Signal Name***	***Function***	***Type***
	*c-1*	*S-Video*	*S-Video*	*O*
	1	*Yn*	*S-Video(Y/C)/NTSC*	*O*
	2	*Cn*	*Composite/NTSC*	*O*
	3	*Y*	*S-Video(Y/C)/PAL*	*O*
	4	*C*	*Composite/PAL*	*O*

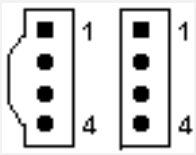
4.2.3.10. 4-Wire LCD Touch Panel Connector：CN26 or CN28

Touch panel could be interfaced from COM or USB. APC-6410 also provides with a 4-wire FPC connector for touch panel. The controller is from ADC of the processor.

The following table shows the pin-out of the touch panel connector.

CN19：*Location on Board, A1*

Table 4.23 4-wire LCD Touch Panel Connector

Table 4.23:	***4-Wire LCD Touch Panel Connector (CN26 or CN28)***		
Description	***1.0 ZIF FPC SMT V/T or HEADER DIP 1*4P 180D MALE 2.54mm***		
Header	***Pin***	***Signal Name***	***Function***
	*1*	*XM*	*Left*
	2	*YP*	*Bottom*
	3	*XP*	*Right*
	4	*YM*	*Top*

Note：

CN26 and CN28 shares the same signals. People can use them depend on the connector type.

4.2.3.11. USB Device Port：CN19

One USB specification version 2.0 compatible USB device port is on board.

The following table shows the pin-out of the USB device connector.

CN19：*Location on Board, D6*

Table 4.24 USB Device Connector

Table 4.24:	***USB Device Connector (CN19)***			
Description	***USB mini Type B Female Connector***			
Header	***Pin***	***Signal Name***	***Function***	***Type***
	1	*+5V*	*Power Supply*	*PO*
	2	*Data-*	*Data-*	*IO*
	3	*Data+*	*Data+*	*IO*
	4	*ID*	*Host cable identification*	*IO*
	5	*GND*	*Ground*	*P*

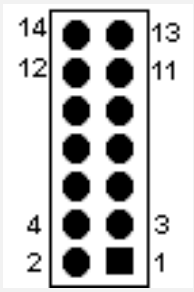
4.2.3.12. GPIO Connector：CN25

The board supports 12-bit GPIO through GPIO connector. (CN25) The 12 digital in- and out-puts can be programmed to read or control devices, with input or output defined.

The following table shows the pin-out of the GPIO connector.

CN25：*Location on Board, C8*

Table 4.25 GPIO Connector

Table 4.25:	***GPIO Connector (CN25)***			
Description	***BOX HEADER DIP 7*2P 180D MALE 2.0mm***			
Header	***Pin***	***Signal Name***	***Function***	***Type***
	*1*	*VCC (+3.3V)*	*Power Supply*	*PO*
	2	*GND*	*Ground*	*P*
	3	*GPIO1*	*GPIO*	*IO*
	4	*GPIO7*		*IO*
	5	*GPIO2*		*IO*
	6	*GPIO8*		*IO*
	7	*GPIO3*		*IO*
	8	*GPIO9*		*IO*
	9	*GPIO4*		*IO*
	10	*GPIO10*		*IO*
	11	*GPIO5*		*IO*
	12	*GPIO11*		*IO*
	13	*GPIO6*		*IO*
	14	*GPIO12*		*IO*

Device Descriptor: */dev/gpioctl*

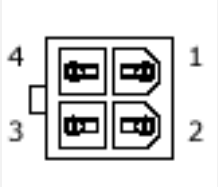
4.2.3.13. Main Power Connector：CN8

This power interface is an option to the AT/ATX power interface and uses the connector CN8 (4 pins). In this case the APC-6410 require +5V-only to be supplied to the board. The +3.3V for onboard and external low-power devices is generated on board by a DC/DC converter. However, the +12V that may be required for LCD panel backlight inverter or other external devices, is not generated on board and needs to be additionally supplied by users.

The following table shows the pin-out of the connector.

CN8：*Location on Board, A2*

Table 4.26 Main Power Connector

Table 4.26:	***Power Connector (CN8)***			
Description	***4 pins ATX Mini-Fit Connector, Molex* 39-31-0048 or equivalent***			
Header	***Pin***	***Signal Name***	***Function***	***Type***
	*1*	*GND*	*Ground*	*P*
	2	*+ 12V*	*Power Input*	*PI*
	3	*+ 5V*	*Power Input*	*PI*
	4	*GND*	*Ground*	*P*

Note：

To protect the external power lines of peripheral devices, make sure that:

(1) The wires have the right diameter to withstand the maximum available current.

(2) The enclosure of the peripheral device fulfils the fire-protecting requirements of IEC/EN 60950.

(3) The current of the pins on this connector is limited to 13A/pin.

4.2.3.14. Buzzer Connector：CN12

The buzzer on APC-6410 is controlled by PWM. The rated frequency is 2731 ± 200Hz.

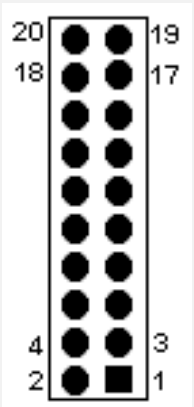
CN12：*Location on Board, A7*

4.2.3.15. JTAG Connector：CN5

JTAG interface commonly used to develop, debug and test microprocessor-based system. APC-6410 uses a 20-pins connector. The following table shows the pin outs of the JTAG connector.

CN5：*Location on Board, A2/A3*

Table 4.27 JTAG Connector

Table 4.27:	***JTAG Connector (CN5)***		
Description	***BOX HEADER DIP 10*2P 180D MALE 2.54mm***		
Header	***Pin***	***Signal Name***	***Function***
	*1*	*VCC*	*Power Supply*
	2	*GND*	*Ground*
	3	*nTRST*	*Test Reset*
	4	*GND*	*Ground*
	5	*TDI*	*Test Data Input*
	6	*GND*	*Ground*
	7	*TMS*	*Test Mode Select*
	8	*GND*	*Ground*
	9	*TCK*	*Test Clock*
	10	*GND*	*Ground*
	11	*RTCK*	*JTAG Retimed Clock*
	12	*GND*	*Ground*
	13	*TDO*	*Test Data Output*
	14	*GND*	*Ground*
	15	*nREST_IN*	*Target System Reset*
	16	*GND*	*Ground*
	17	*NC*	*Not Connected*
	18	*GND*	*Ground*
	19	*NC*	*Not Connected*
	20	*GND*	*Ground*

Backup and Restore the Root File System in SD Card

This Chapter details how to backup and restore the root file systems in SD card of APC-6410.

Section include：

- Backup the root file systems in SD card
- Restore the root file systems in SD card

Chapter 5 Backup and Restore the Root File System in SD Card

This chapter is mainly for Linux users. For Windows CE 6.0 users, NK is stored in NAND flash and users can neglect this chapter.

This chapter gives an instruction in regarding to how to backup and restore the root file systems in SD card. First, we would like to detail how to backup the root file system in SD card and next, we would like to tell you how to restore the root file system in SD card.

5.1 Backup the root file system in SD card

After developing your program under the Ubuntu Jaunty Jackalope (Ubuntu 9.04), users might want to backup the whole file system. In this section, we will tell users how to backup the whole root file system.

Take the SD/SDHC card off from the device and plug it into a USB SD/SDHC card reader and plug the card reader into the USB port of your Linux PC. The operating system of the Linux PC in this example is Ubuntu 11.04 and the SDHC card storage is 8GB.

Use the # *fdisk -l* command to list your disk information and find the device descriptor of you SD USB reader.

```
root@dns3:~# fdisk -l

Disk /dev/sda: 1000.2 GB, 1000203804160 bytes
255 heads, 63 sectors/track, 121601 cylinders
Units = cylinders of 16065 * 512 = 8225280 bytes
Sector size (logical/physical): 512 bytes / 512 bytes
I/O size (minimum/optimal): 512 bytes / 512 bytes
Disk identifier: 0x000d8811

   Device Boot      Start         End      Blocks   Id  System
/dev/sda1   *           1       24316   195311616   83  Linux
/dev/sda2           24316       24565     1999872   82  Linux swap /
Solaris
/dev/sda3           24565      121602   779448320   83  Linux
```

```
 Disk /dev/sdb: 7948 MB, 7948206080 bytes
81 heads, 10 sectors/track, 19165 cylinders
Units = cylinders of 810 * 512 = 414720 bytes
Sector size (logical/physical): 512 bytes / 512 bytes
I/O size (minimum/optimal): 512 bytes / 512 bytes
Disk identifier: 0x00000000

   Device Boot      Start         End      Blocks   Id  System
/dev/sdb1               1       19165     7761820   83  Linux
root@dns3:~#
```

We can see the device descriptor of the USB SD card reader is in disk */dev/sdb* and there is one partition */dev/sdb1*. (Note: The device descriptor might be different in your Linux PC.)

Next, mount SD/SDHC card to */mnt* directory and change directory to the */mnt*.

```
root@dns3:~# mount -t ext3 /dev/sdb1 /mnt
root@dns3:~# cd /mnt
root@dns3:/mnt#
```

You can *ls* the file structure.

```
root@dns3:/mnt# ls
bin  etc   lib  opt   root  selinux  tmp  var
dev  home  mnt  proc  sbin  sys      usr
root@dns3:/mnt#
```

Next, tar the file system into a file. (The file name in this example is u904.090930_backup.tar.gz)

```
root@dns3:/mnt# tar cvfz u904.090930_backup.tar.gz
root@dns3:/mnt#
```

You have backup the SD/SDHC root file systems as a file name *"320rootfs_backup.tar.gz"*!

5.2 Restore the root file system in SD card

Plug a SD/SDHC card into a USB card reader and plug the card reader into the USB port of your Linux PC. The operating system of the Linux PC in this example is Ubuntu 11.04 and the SDHC card storage is 8GB. (Note: 2GB is minimal requirement for the Embedian official root file system.)

Use the # *fdisk -l* command to list your disk information and find the device descriptor of you SD/SDHC USB reader.

```
root@dns3:~# fdisk -l

Disk /dev/sda: 1000.2 GB, 1000203804160 bytes
255 heads, 63 sectors/track, 121601 cylinders
Units = cylinders of 16065 * 512 = 8225280 bytes
Sector size (logical/physical): 512 bytes / 512 bytes
I/O size (minimum/optimal): 512 bytes / 512 bytes
Disk identifier: 0x000d8811

   Device Boot      Start         End      Blocks   Id  System
/dev/sda1   *           1       24316   195311616   83  Linux
/dev/sda2           24316       24565     1999872   82  Linux swap /
Solaris
/dev/sda3           24565      121602   779448320   83  Linux

 Disk /dev/sdb: 7948 MB, 7948206080 bytes
81 heads, 10 sectors/track, 19165 cylinders
Units = cylinders of 810 * 512 = 414720 bytes
Sector size (logical/physical): 512 bytes / 512 bytes
I/O size (minimum/optimal): 512 bytes / 512 bytes
Disk identifier: 0x00000000

   Device Boot      Start         End      Blocks   Id  System
/dev/sdb1               1       19165     7761820   83  Linux
root@dns3:~#
```

We can see the device descriptor of the USB SD/SDHC card reader is in disk */dev/sdb* and there is one partition */dev/sdb1*. (Note: The device descriptor might be different in your Linux PC.)

If there is no partition in your SD/SDHC card, you have to use *fdisk* to partition

it first, here we partitioned the SD card as one partition. (New SD/SDHC card should have one partition already by default.)

```
root@dns3:~# fdisk /dev/sdb

WARNING: DOS-compatible mode is deprecated. It's strongly recommended
to
         switch off the mode (command 'c') and change display units to
         sectors (command 'u').

Command (m for help): d
Selected partition 1

Command (m for help): n
Command action
   e   extended
   p   primary partition (1-4)
p
Partition number (1-4): 1
First cylinder (1-19165, default 1):
Using default value 1
Last cylinder, +cylinders or +size{K,M,G} (1-19165, default 19165):
Using default value 19165

Command (m for help): w
The partition table has been altered!

Calling ioctl() to re-read partition table.
Syncing disks.
root@dns3:~#
```

Next, we need to format the SD/SDHC card as ext3 file system by using # *mkfs -t ext3 /dev/sdb1* command. (In FC, you can also use # *mkfs.ext3 /dev/sdb1* command.)

```
root@dns3:~# mkfs -t ext3 /dev/sdb1
```

```
mke2fs 1.41.14 (22-Dec-2010)
Filesystem label=
OS type: Linux
Block size=4096 (log=2)
Fragment size=4096 (log=2)
Stride=0 blocks, Stripe width=0 blocks
485760 inodes, 1940455 blocks
97022 blocks (5.00%) reserved for the super user
First data block=0
Maximum filesystem blocks=1988100096
60 block groups
32768 blocks per group, 32768 fragments per group
8096 inodes per group
Superblock backups stored on blocks:
        32768, 98304, 163840, 229376, 294912, 819200, 884736, 1605632

Writing inode tables: done
Creating journal (32768 blocks): done
Writing superblocks and filesystem accounting information: done

This filesystem will be automatically checked every 25 mounts or
180 days, whichever comes first.  Use tune2fs -c or -i to override.
root@dns3:~
```

And next, mount SD/SDHC card to */mnt* directory and change directory to the */mnt*.

```
root@dns3:/# mount -t ext3 /dev/sdb1 /mnt
root@dns3:/# cd /mnt
root@dns3:/mnt#
```

Next, *cp* the rootfs file u904.090930.tar.gz into /mnt directory and extracting the root file system file into this directory.

```
root@dns3:/mnt# ls
lost+found  u904.090930.tar.gz
root@dns3:/mnt#
```

You can *ls* the file structure now.

```
root@dns3:/mnt# ls
bin    dev   lib         mnt   proc  selinux  tmp                  var
boot   etc   lost+found  nand  root  srv      u904.090930.tar.gz
build  home  media       opt   sbin  sys      usr
root@dns3:/mnt#
```

Last, remove the tarball and leave the */mnt* directory and *umount* the device.

```
root@dns3:/mnt# rm -f 320rootfs_20090918.tar.gz
root@dns3:/mnt# cd ../
root@dns3:/# umount /mnt
root@dns3:/#
```

Take the SD/SDHC card off from the card reader and put the SD/SDHC card back to SBC and boot. You are done!

Additional Packages

If users attached a touch screen LCD, additional packages for touch needed to be installed. Plug the above SD/SDHC card into APC-6410 and power on and login to the device.

Change directory to */tmp* first and copy the "*ts_upgrade.tar.gz*" into the device.

```
root@ubuntu:~# cd /tmp
root@ubuntu:/tmp# ls
root@ubuntu:/tmp# lftp eric@59.124.115.45
Password:
lftp eric@59.124.115.45:~> get ts_upgrade.tar.gz
580432 bytes transferred
lftp eric@59.124.115.45:~> bye
root@ubuntu:/tmp# ls
ts_upgrade.tar.gz
root@ubuntu:/tmp#
```

Extract this tarball and execute the shell script as follows.

```
root@ubuntu:/tmp# tar xvfz ts_upgrade.tar.gz
embedian-mxm6410-touchscreen.deb
install.sh
root@ubuntu:/tmp# ./install.sh
Reading package lists... Done
Building dependency tree
Reading state information... Done
```

Reboot, and you will see the calibration program on the screen. There are five cross points for users to calibrate. The calibration value will be stored in the NAND flash after calibrated. APC-6410 will check if this calibration value exists there or not at next boot. If yes, users will not need to calibrate every time.

Note:
Users need to connect a touch screen to APC-6410 when install this package, or the boot up process will stop to wait you input the calibration value.

After calibration, it will bring you to the gdm login screen. To re-calibrate, users can use the following command line.

```
# ts_calibrate
```

Or user can be pending at the screen for a few seconds during boot process to re-calibrate. In this way, no command line needed if users would like to do re-calibration.

Using Ubuntu Jaunty Jackalope (9.04)

This Chapter details how to use the Ubuntu Linux of APC-6410 single board computer.

Section include：

- Booting
- Default root pass and user
- Network Setting
- Manually add repositories
- Install Software Packages
- COM Port
- LCD
- GPIO
- FTP Client
- FTP Server

- Telnet/SSH Server
- VNC server
- GDM
- LXDE
- Calibration and Touch Screen
- Kiosk Mode
- NAND Root File System
- Cross Toolchain

Chapter 6 Using Ubuntu Jaunty Jackalope

Ubuntu 9.04 (as known as Jaunty Jackalope) is official released on April 23rd of 2009. And Embedian is one of the first few companies to support Ubuntu 9.04 for ARM11 processors. This Chapter gives an overall picture in regarding to the Ubuntu Linux 9.04 features that Embedian provided with for the APC-6410 single board computer.

This chapter gives an introduction in regarding to use the Ubuntu Linux 9.04 Jaunty Jackalope system on APC-6410 single board computers. This guide is mainly focus on the topic related to Embedian's products. This guide is not an official Ubuntu documentation. But still, a good reference for those people who are interested in Ubuntu 9.04.

6.1 Board Support Package (BSP)

The Embedian Board Support Package for Ubuntu Linux 9.04 is one of the most advanced BSPs available in the market. Beside the standard Ubuntu Linux functionality, it also includes a large number of additional drivers as well as optimized versions from standard drivers.

The Embedian Linux kernel is provided with a source code and binary format. This allows customers to customize the external device drivers themselves. With Ubuntu support, this relieves the application-developer from the burden of creating and building the own images. Instead the necessary adaptations can be done by using ***apt-get*** the software packages from the official Ubuntu 9.04 repository to the on-board root file system.

Customers who follow the built instruction in the BSP will enable you to build exactly the same Linux kernel zImage as Embedian provides by default.

6.1.1. Drivers

The following drivers are integrated in the standard image that comes pre-installed with each APC-6410 board.

Table 6.1 Drivers

Table 6.1	***Drivers***
Driver	***Description***
COM1	*Support RXD/TXD/CTS/RTS*
COM2	*Support RXD/TXD*
COM3	*Support RXD/TXD*
COM4	*External UART that supports the full RS232 specification with all 9 signals.*
COM5	*External UART that supports the full RS232 specification with all 9 signals.*
Ethernet	*10/100Mbit driver for Davicom DM9000B*
USB Host	*4 Ports supporting mass storage devices (USB-stick, hard disk…) and other devices as keyboard, mouse, USB hub…*
USB OTG	*Client*
Audio	*16Bit stereo output (up to 48kHz), mic input, line-In supports ALSA standard APIs*
Touch Screen	*All 4-wire resistive screens supported*
Display	*All types of displays supported. Use **fbset** utility to configure different resolutions and panels.*
SD/SDHC	*Memory cards, Wireless LAN, Bluetooth, GSM, GPS …*
CF	*Memory cards, Wireless LAN, modem, Bluetooth, serial card, GPS, GSM, …*
GPIO	*12 Configurable GPIO with Sample codes.*
Flash File System	*Ext3 and FAT32 are default supported*
2D Engine	*CPU 2D acceleration h/w supported*
3D Engine	*Support CPU 3D h/w acceleration. Support OpenGLES 1.1/2.0.*
TV-Out	*TV output driver for NTSC/PAL format is supported*
Camera	*Camera drivers for various camera modules*
MFC Engine	*Support h/w H.263, H.264, VC1*
SPI	*High speed SPI supported*
RTC	*Real time clock driver*

6.1.2. Default Software Packages

Users can use ***dpkg-query -W*** to visualize the list of installed packages or ***dpkg –l*** to obtain the description of the set of installed packages. User can

add their application oriented packages from the Ubuntu repository by using ***apt-get install <Package Name>*** as well.

6.1.3. Booting

When power on, the uboot will initialize the low-level hardware and bring the Linux kernel to DDR RAM. After that, the Linux kernel will take over the system. The linuxrc is a program that is started in the start-up stage of the kernel prior to the actual boot process. This allows you to boot a small modularized kernel and to load only few drivers that are really needed as modules. linuxrc assists in loading relevant drivers manually. The use of linuxrc provides with the choices to boot into a small root file system in NAND or the Ubuntu 9.04 system in SD/SDHC card. (The default is set to boot into SD/SDHC card if no key is pressed during boot process.)

```
      Root Filesystem Selection

       1) SD Card
       2) NAND

       Please enter your choice:
Boot from SD Partition 1
```

The NAND file system is in ext3 format and can be served as a disk-based rescue system or for some simpler applications that don't need a SD root file system at all. For more details in regarding to NAND file system, users can refer to section 6.15.

If you have LCD attached, users should be able to see the following gdm login screen showing on your LCD.

Username:
Options
Tue Feb 24, 9:41 PM

6.2 Default root pass and user

The default ***root*** password is ***mxm6410*** and default user is ***ubuntu*** and the ubuntu user default password is also ***mxm6410***.

6.2.1 Create a User

To add a user, you can use ***useradd*** command.

```
ubuntu@ubuntu:~$ useradd --help
Usage: useradd [options] LOGIN

Options:
  -b, --base-dir BASE_DIR       base directory for the new user account
                                home directory
  -c, --comment COMMENT         set the GECOS field for the new user
account
  -d, --home-dir HOME_DIR       home directory for the new user account
  -D, --defaults                print or save modified default useradd
                                configuration
  -e, --expiredate EXPIRE_DATE  set account expiration date to
EXPIRE_DATE
  -f, --inactive INACTIVE       set password inactive after expiration
                                to INACTIVE
  -g, --gid GROUP               force use GROUP for the new user account
  -G, --groups GROUPS           list of supplementary groups for the new
                                user account
  -h, --help                    display this help message and exit
  -k, --skel SKEL_DIR           specify an alternative skel directory
  -K, --key KEY=VALUE           overrides /etc/login.defs defaults
  -l,                           do not add the user to the lastlog and
                                faillog databases
  -m, --create-home             create home directory for the new user
                                account
  -N, --no-user-group           do not create a group with the same name
as
                                the user
  -o, --non-unique              allow create user with duplicate
                                (non-unique) UID
```

```
  -p, --password PASSWORD       use encrypted password for the new user
                                account
  -r, --system                  create a system account
  -s, --shell SHELL             the login shell for the new user account
  -u, --uid UID                 force use the UID for the new user account
  -U, --user-group              create a group with the same name as the
user

ubuntu@ubuntu:~$
```

6.2.2 Set User Password

After create a user, you can use ***passwd*** command to set the password.

```
ubuntu@ubuntu:~$ passwd --help
Usage: passwd [options] [LOGIN]

Options:
  -a, --all                   report password status on all accounts
  -d, --delete                delete the password for the named
account
  -e, --expire                force expire the password for the named
account
  -h, --help                  display this help message and exit
  -k, --keep-tokens           change password only if expired
  -i, --inactive INACTIVE     set password inactive after expiration
                              to INACTIVE
  -l, --lock                  lock the password of the named account
  -n, --mindays MIN_DAYS      set minimum number of days before
password
                              change to MIN_DAYS
  -q, --quiet                 quiet mode
  -r, --repository REPOSITORY change password in REPOSITORY repository
  -S, --status                report password status on the named
account
  -u, --unlock                unlock the password of the named account
  -w, --warndays WARN_DAYS    set expiration warning days to WARN_DAYS
  -x, --maxdays MAX_DAYS      set maximim number of days before
password
                              change to MAX_DAYS

ubuntu@ubuntu:~$
```

Example:

Below is an example to create a user *john* with home directory and set his password.

```
ubuntu@ubuntu:~$ sudo useradd -m john
ubuntu@ubuntu:~$ sudo passwd john
Enter new UNIX password:
Retype new UNIX password:
passwd: password updated successfully
ubuntu@ubuntu:~$
```

6.2.3 Delete a User

To delete a user, you can use ***userdel*** command.

```
ubuntu@ubuntu:~$ userdel --help
Usage: userdel [options] LOGIN

Options:
  -f, --force                   force removal of files,
                                even if not owned by user
  -h, --help                    display this help message and exit
  -r, --remove                  remove home directory and mail spool

ubuntu@ubuntu:~$
```

Example:

Below is an example to delete a user *john* with removal of home directory and mail spool.

```
ubuntu@ubuntu:~$ sudo userdel -r john
ubuntu@ubuntu:~$
```

6.3 Network Settings

The default network is set as DHCP. User can use *ifconfig eth0* command to check the device IP address.

```
ubuntu@ubuntu:~$ ifconfig eth0
```

```
eth0      Link encap:Ethernet  HWaddr 10:0d:32:10:01:12
          inet addr:192.168.1.121  Bcast:192.168.1.255
Mask:255.255.255.0
          UP BROADCAST RUNNING MULTICAST  MTU:1500  Metric:1
          RX packets:95 errors:0 dropped:0 overruns:0 frame:0
          TX packets:3 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:12326 (12.3 KB)  TX bytes:158 (158.0 B)
          Interrupt:72 Base address:0xe300

ubuntu@ubuntu:~$
```

Users can use ***ifconfig*** to change the IP address at runtime.

Example:

Below is an example to change the IP address to 192.168.1.122 and netmask to 255.255.255.0 at runtime.

```
ubuntu@ubuntu:~$ sudo ifconfig eth0 192.168.1.122 netmask 255.255.255.0
up
ubuntu@ubuntu:~$
```

Note:

Every MAC address on board will be mapping to Embedian's serial number and is compliant to ISO/IEC 8802 standards. The MAC address is written on EEPROM of the board at factory and Linux kernel driver will read it automatically. There is no way that users can change it from root file systems.

6.3.1 Configure Network Configuration at Boot or Network Restart

The *ifconfig* command only changes the network setting at runtime. After reboot or network restart, the network configuration will be restored to default values. To configure the network configuration at boot or network restart, users need to modify the */etc/network/interfaces* file. Network configuration will take effect at next boot or network restart.

6.3.1.1 Static IP

To configure the device networking configuration as static IP, user need to modify the */etc/network/interfaces* file first.

```
ubuntu@ubuntu:~$ vim /etc/network/interfaces
```

Modify the network configurations as follows

After modified this file, you can reboot the device or just use the */etc/init.d/networking restart* command to restart the networking configuration to get the new network configurations.

```
auto lo
iface lo inet loopback
auto eth0
iface eth0 inet static
        address 192.168.1.121
        netmask 255.255.255.0
        gateway 192.168.1.254
```

6.3.1.2 DHCP

To configure the device networking configuration as DHCP, user need to modify the */etc/network/interfaces* as follows.

```
auto lo
iface lo inet loopback
auto eth0
#iface eth0 inet static
#       address 192.168.1.121
#       netmask 255.255.255.0
#       gateway 192.168.1.254
iface eth0 inet dhcp
```

After modified this file, you can reboot the device or just use the */etc/init.d/networking restart* command to restart the networking configuration.

```
ubuntu@ubuntu:~$ sudo /etc/init.d/networking restart
```

```
 * Reconfiguring network interfaces...
Internet Systems Consortium DHCP Client V3.1.1
Copyright 2004-2008 Internet Systems Consortium.
All rights reserved.
For info, please visit http://www.isc.org/sw/dhcp/

Listening on LPF/eth0/10:0d:32:10:01:12
Sending on   LPF/eth0/10:0d:32:10:01:12
Sending on   Socket/fallback
Internet Systems Consortium DHCP Client V3.1.1
Copyright 2004-2008 Internet Systems Consortium.
All rights reserved.
For info, please visit http://www.isc.org/sw/dhcp/

Listening on LPF/eth0/10:0d:32:10:01:12
Sending on   LPF/eth0/10:0d:32:10:01:12
Sending on   Socket/fallback
DHCPDISCOVER on eth0 to 255.255.255.255 port 67 interval 4
DHCPDISCOVER on eth0 to 255.255.255.255 port 67 interval 4
DHCPOFFER of 192.168.1.54 from 192.168.1.254
DHCPREQUEST of 192.168.1.54 on eth0 to 255.255.255.255 port 67
DHCPACK of 192.168.1.54 from 192.168.1.254
bound to 192.168.1.54 -- renewal in 40595 seconds.

[ OK ]
ubuntu@ubuntu:~$
```

You can see the device IP has been assigned as 192.168.1.54 after network restart.

Note:

At development stage, users might take the MXM-6410 module off from the carrier board and replace by the other new module. If that is the case, Ubuntu will find out the MAC address has been changed and will view the original eth0 network device as eth1. The network configuration settings mentioned above will not take effect. If users want to change the network configuration setting under this situation, you

need to modify the */etc/udev/rules.d/70-persistent-net.rules* file first time when you replace the CPU module.

```
ubuntu@ubuntu:~$ sudo vim /etc/udev/rules.d/70-persistent-net.rules
```

And delete the following lines.

```
# net device ()
SUBSYSTEM=="net", ACTION=="add", DRIVERS=="?*",
ATTR{address}=="10:0d:32:10:01:1
2", ATTR{type}=="1", KERNEL=="eth*", NAME="eth0"
```

After next reboot or network restart, Ubuntu will generate the new settings into this file to this file to fix the network device interface.

6.4 Manually Add Repositories

Do this at your own risk. Modify the default Ubuntu sources.list only if you understand what you're doing. Mixing repositories can **break** your system. For more information see the Ubuntu Command-line Repository guide.

Create a backup of your current list of sources.

```
ubuntu@ubuntu:~$ sudo cp -p /etc/apt/sources.list
/etc/apt/sources.list_backup
ubuntu@ubuntu:~$
```

Note:

1. *sudo* - runs the command with root privileges. *cp* = copy. *-p* = prompt to overwrite if a file already exists.

2. Edit the list of sources:

```
ubuntu@ubuntu:~$ sudo vim /etc/apt/sources.list
```

The default repositories are:

```
deb http://old-releases.ubuntu.com/ubuntu jaunty main restricted
universe multiverse
```

After modified the sources.list, you need to run apt-install update to acquire the update packages.

```
ubuntu@ubuntu:~$ sudo apt-get update
```

3. To use your local mirror you can add "*xx.*" before *archive.ubuntu.com*, where **xx** = your country code.

Example: *deb http://gb.archive.ubuntu.com/ubuntu jaunty main restricted universe multiverse* indicates a repository for Great Britain (gb).

6.5 Install Software Packages

6.5.1 List of installed software packages

To visualize the list of installed packages, we use the following command

```
ubuntu@ubuntu:~$ dpkg-query -W
```

To visualize an installed package whose name is ***vim*** for example, we use the previous command and a redirection (or pipeline) to the *grep* command. Practically, we have:

```
buntu@ubuntu:~$ dpkg-query -W |grep -i vim
vim      2:7.2.079-1ubuntu5
vim-common       2:7.2.079-1ubuntu5
vim-runtime      2:7.2.079-1ubuntu5
vim-tiny         2:7.2.079-1ubuntu5
ubuntu@ubuntu:~$
```

6.5.2 Description of installed software packages

The description of the set of installed packages is obtained via the command

```
ubuntu@ubuntu:~$ dpkg -l
```

6.5.3 List of available software packages

The list of available packages is obtained as follows:

```
ubuntu@ubuntu:~$ apt-cache pkgnames
```

We clearly see that the list is not in alphabetical order. To resolve this issue, we redirect and sort the output:

```
ubuntu@ubuntu:~$ apt-cache pkgnames |sort
```

6.5.4 Searching a software package: apt-cache search

To search a software package, we proceed as follows:

```
ubuntu@ubuntu:~$ apt-cache search wget
devscripts - scripts to make the life of a Debian Package maintainer easier
emacs-goodies-el - Miscellaneous add-ons for Emacs
wget - retrieves files from the web
abcde - A Better CD Encoder
apt-mirror - APT sources mirroring tool
apt-zip - Update a non-networked computer using apt and removable media
axel - light download accelerator - console version
axel-dbg - light download accelerator - debugging symbols
axel-kapt - light download accelerator - graphical front-end
epiphany-extension-gwget - Gwget extension for Epiphany web browser
gtm - Multiple files transfer manager
gwget - GNOME front-end for wget
mirror - keeps FTP archives up-to-date
puf - Parallel URL fetcher
snarf - A command-line URL grabber
wget-el - an interface for wget on Emacsen
wput - A tiny wget-like ftp-client for uploading files
ubuntu@ubuntu:~$
```

This command displays software packages containing the expression ***wget***.

6.5.5 Properties and information of a software: apt-cache show

To display information related to a package, for instance the ***gwget*** package, we proceed as follows:

```
ubuntu@ubuntu:~$ apt-cache show gwget
Package: gwget
Priority: optional
Section: universe/gnome
Installed-Size: 1336
Maintainer: Ubuntu MOTU Developers
Original-Maintainer: Arnaud Fontaine
Architecture: armel
Source: gwget2
Version: 1.0.1-0ubuntu1
Replaces: gwget2
Provides: gwget2
Depends: libart-2.0-2 (>= 2.3.18), libatk1.0-0 (>= 1.20.0), libbonobo2-0
(>= 2.1
5.0), libbonoboui2-0 (>= 2.15.1), libc6 (>= 2.4), libcairo2 (>= 1.2.4),
libdbus-
1-3 (>= 1.0.2), libdbus-glib-1-2 (>= 0.78), libfontconfig1 (>= 2.4.0),
libfreety
pe6 (>= 2.2.1), libgconf2-4 (>= 2.13.5), libglade2-0 (>= 1:2.6.1),
libglib2.0-0
(>= 2.16.0), libgnome2-0 (>= 2.17.3), libgnomecanvas2-0 (>= 2.11.1),
libgnomeui-
0 (>= 2.22.0), libgnomevfs2-0 (>= 1:2.17.90), libgtk2.0-0 (>= 2.16.0),
libice6 (
>= 1:1.0.0), libnotify1 (>= 0.4.4), libnotify1-gtk2.10, liborbit2 (>=
1:2.14.10)
, libpango1.0-0 (>= 1.14.0), libpixman-1-0, libpng12-0 (>= 1.2.13-4),
libpopt0 (
>= 1.14), libsm6, libx11-6, libxcb-render-util0 (>= 0.2.1+git1),
libxcb-render0,
 libxcb1 (>= 1.1.92), libxml2 (>= 2.6.27), libxrender1, zlib1g (>=
1:1.1.4), gco
nf2 (>= 2.10.1-2), wget (>= 1.10)
Conflicts: epiphany-extension-gwget (<< 0.97-1), gwget2
Filename: pool/universe/g/gwget2/gwget_1.0.1-0ubuntu1_armel.deb
```

```
Size: 230510
MD5sum: 45aad4ccc0f0d9c657ec588d14ec73d4
SHA1: e8f95b0957af34be40c595ee9550508afaf8a5c8
SHA256:
942cfb10fd3d2f6f7517102e461ebd15cf6d495703c8e8a17338d1871d259e44
Description: GNOME front-end for wget
 Gwget offers a GNOME front-end to the popular wget application, with
 enhanced features, such as systray icon, multiple downloads and a
 powerful preferences manager.
Homepage: http://gnome.org/projects/gwget/
Bugs: https://bugs.launchpad.net/ubuntu/+filebug
Origin: Ubuntu

ubuntu@ubuntu:~$
```

Note that the *exact* name of the package should be entered! For example,

```
ubuntu@ubuntu:~$ apt-cache show flash
W: Unable to locate package flash
E: No packages found
ubuntu@ubuntu:~$
```

This does not yield any result since **flash** is not the name of a package.

6.5.6 Installing a software: apt-get install

Assume we want to install ***firefox***. We type:

```
ubuntu@ubuntu:~$ sudo apt-get install firefox
```

6.5.7 Removing a software: apt-get remove

To uninstall a package, we can proceed in two ways. Either 1) we uninstall only the software or 2) the software and its configuration files.

In the first case, assuming we want to uninstall the ***mplayer*** software, we type:

```
ubuntu@ubuntu:~$ sudo apt-get remove mplayer
```

In the second case, if we want to uninstall both ***mplayer*** and its ***configuration files***, we type:

```
ubuntu@ubuntu:~$ sudo apt-get remove --purge mplayer
```

6.5.8 Updating the software list: apt-get update

Updating a list of software is not the same as updating the software *per se*. Only the list is actually updated:

```
sudo apt-get update
```

6.5.9 Upgrading the software: apt-get upgrade

The ***upgrade*** command installs the most recent versions of all packages on the system.

```
ubuntu@ubuntu:~$ sudo apt-get upgrade
```

To simulate an update installation, i.e. to see which software will be updated, we type:

```
ubuntu@ubuntu:~$ sudo apt-get -s upgrade
```

6.5.10 Smart software update: apt-get dist-upgrade

The ***dist-upgrade*** command has the same effect as the 'upgrade' except that a smart management is used in changes of dependencies in new versions: conflict resolution and discarding less important packages for more important ones, for example.

```
ubuntu@ubuntu:~$ sudo apt-get dist-upgrade
```

6.6 COM Port

There are six RS232 ports and one RS422/485 port in APC-6410. Four of them (CN20 and CN21) are from CPU internal and two of them (CN23) are from external DUART chip TL16C752B. The pin 1-10 of CN20 (UART0) also plays the role of debug port. The RS422/485 port (CN22) share with one of the RS232 (pin 11-20 of CN20) by JP3 jumper selection. That means, RS232 from pin 11-20 of CN20 and RS422/585 (CN22) cannot be used simultaneously.

The device descriptor of COM ports is as follows.

6.6.1 CPU

CN20 → */dev/ttySAC0* (*Console*, pin 1~9) and */dev/ttySAC1* (*UART1*, pin 11~19)

CN21 → */dev/ttySAC2* (*UART2*, pin 1~9) and */dev/ttySAC3* (*UART3*, pin 11~19)

6.6.2 TL16C752B

To use these COM ports, you need to load the drivers first by the following command.

 # modprobe 8250

```
ubuntu@ubuntu:~$ sudo modprobe 8250
ubuntu@ubuntu:~$
```

CN23 --> */dev/ttyS0* (*UART4*, pin 1~9) and */dev/ttyS1* (*UART5*, pin 11~19)

Note:

Users can use *apt-get install minicom* to use *minicom* program to test the COM port device first.

6.7 LCD

The device descriptor of the LCD is */dev/fb0*. The default LCD output will be Ubuntu gdm login screen.

LCD driver is default built in the kernel instead of driver module.

If your LCD panel is in different resolutions other than 800x480, users also need to use *fbset* command to set up the frame buffer first. You need to *apt-get install* fbset package and fbset the framebuffer as follows.

```
root@ubuntu:/etc/apt# sudo apt-get install fbset
Reading package lists... Done
Building dependency tree
Reading state information... Done
The following NEW packages will be installed:
  fbset
0 upgraded, 1 newly installed, 0 to remove and 14 not upgraded.
Need to get 115kB of archives.
After this operation, 365kB of additional disk space will be used.
Get:1 http://old-releases.ubuntu.com jaunty/main fbset 2.1-23 [115kB]
Fetched 115kB in 2s (50.6kB/s)
Selecting previously deselected package fbset.
(Reading database ... 34128 files and directories currently installed.)
Unpacking fbset (from .../fbset_2.1-23_armel.deb) ...
Setting up fbset (2.1-23) ...

ubuntu@ubuntu:/etc/apt# fbset 800x480-0
ubuntu@ubuntu:/etc/apt#
```

The settings are located in the file ***/etc/fb.modes***. Different LCDs have different settings. You can add your own LCD settings into this file and fbset it.

6.8 GPIO

GPIO driver is default built in the kernel instead of driver module. Users need to create a device node first by the following way.

```
ubuntu@ubuntu:~$ sudo mknod /dev/gpioctl c 253 0
ubuntu@ubuntu:~$
```

Below is the sample code for GPIO.

```
/*
 * This program demostrates the contorl of APC-7xxx GPIO ports by using
device descriptor.
 *
 * Device Descriptor:  /dev/gpioctl
 * Operations:
 *      Read:
 *              Returns "GPIO Port Descriptor" representing current GPIO
settings.
 *      Write:
 *              Setup the GPIO ports by using "GPIO Port Descriptor".
 *
 * GPIO Port Descriptor:
 *      The GPIO Port Descriptor contains 12 bytes each for one GPIO port
from J0 to J11.
 *      Each byte has following format:
 * Bit[3:2]     Function        0 = Input,      1 = Output,     2 =
Special,        3 = Reserved
 * Bit[1]               Pullup          0 = Enable,     1 = Disable
 * Bit[0]               Data            0 = Low,        1 = High
 */


#include
#include
#include
#include
#include
#include
```

```
char *dev_desc = "/dev/gpioctl";

struct gpioctl_desc {
        unsigned int dat:1;                     // bit 0
        unsigned int pullup:1;                  // bit 1
        unsigned int func:2;                    // bit 3:2
} __attribute__ ((packed));

void inline byte_to_desc(unsigned char *byte, struct gpioctl_desc *gpio)
{
        gpio->dat       = (*byte >> 0) & 0x1;
        gpio->pullup    = (*byte >> 1) & 0x1;
        gpio->func      = (*byte >> 2) & 0x3;
}

void inline desc_to_byte(unsigned char *byte, struct gpioctl_desc *gpio)
{
        *byte = ( (gpio->func  & 0x3) << 2) |
                ( (gpio->pullup& 0x1) << 1) |
                ( (gpio->dat   & 0x1) << 0) ;
}

int read_dev(unsigned char *buf)
{
        struct gpioctl_desc *gpio = malloc(sizeof(*gpio));
        char *str;
        int fd, i;

        fd = open(dev_desc, O_RDONLY);
        if (fd == -1)
                return -ENODEV;

        i = read(fd, buf, 12);
        close(fd);

        for (i=0; i<12; i++) {
                byte_to_desc(&buf[i], gpio);
```

```
                switch (gpio->func) {
                        case 0:         str = "Input";          break;
                        case 1:         str = "Output";         break;
                        case 2:         str = "System";         break;
                        default:        str = "Reserve";        break;
                }

                printf("GPJ[%d]: function = %s, pullup = %s, data = %d\n",
                                i, str, gpio->pullup ? "Disable" :
"Enable", gpio->dat);
        }

        return 0;
}

int write_dev(unsigned char *buf)
{
        struct gpioctl_desc *gpio = malloc(sizeof(*gpio));
        char *str;
        int fd, i;

        for (i=0; i<12; i++) {
                gpio->func = 1;
                gpio->pullup = 1;
                gpio->dat = 1;
                desc_to_byte(&buf[i], gpio);
        }

        fd = open(dev_desc, O_WRONLY);
        if (fd == -1)
                return -ENODEV;

        write(fd, buf, 12);
        close(fd);

        return 0;
}
```

```
int main()
{
        unsigned char buf[12];
        int i;
        int err;

        err = read_dev(buf);
        if (err)
                return err;

        return write_dev(buf);
}
```

6.9 FTP Client

The ***lftp*** is default included in the root file system. You might use *apt-get install* to use a dedicated ftp client. To use the *ltfp* FTP client, assuming the remote host IP address is *59.124.115.43* and the user is *eric*,

```
ubuntu@ubuntu:~$ sudo lftp -u eric 59.124.115.43
Password:
lftp eric@59.124.115.43:~> bye
ubuntu@ubuntu:~$
```

You can use ***put <filename>*** to put transmit a file from local device to remote server and ***get <filename>*** to get a file from remote server to local device, and use ***bye*** to exit the lftp command mode.

You can also use ***wget*** command to get the file from webserver.

6.10 FTP Server

The ftp server is not included in the root file system by default. However, it is very easy to have one. In this section, we would like to take the ***vsftpd*** server as an example.

First, we need to apt-get install the vsftpd packages.

```
ubuntu@ubuntu:~$ sudo apt-get install vsftpd
```

```
You can use netstat commad to check if the vsftpd has been successfully
installed. ubuntu@ubuntu:/etc/apt# netstat -tul |grep ftp
tcp        0      0 *:ftp                   *:*
LISTEN
ubuntu@ubuntu:/etc/apt#
```

If you saw the ftp has been *LISTEN*, then means the vsftpd is running.

The default vsftpd is configured only allow the a*nonymous* user to ftp in without password. We now need to configure the */etc/vsftpd.conf* file.

```
ubuntu@ubuntu:~$ sudo vim /etc/vsftpd.conf
```

Below are the common settings for vsftpd. For advanced settings, users can read the remarks from the same file.

anonymous_enable=NO (YES means allow the anonymous user to login to ftp. NO means not allow anonymous user to login to ftp)

chroot_local_user=YES (Uncomment this to restrict local users to their home directories and cannot change directory to other system directory.)

local_umask=022 (Uncomment this will make the privilege of the upload file to 755; If comment out this line, the default privilege of upload file is 700.)

local_enable=Yes (Uncomment this to allow local users to log in.)

write_enable=YES (Uncomment this to enable any form of FTP write command.)

After made the changes, we need to restart the vsftpd server by

```
ubuntu@ubuntu:/etc/apt# sudo /etc/init.d/vsftpd restart
```

```
 * Stopping FTP server: vsftpd
[ OK ]
 * Starting FTP server: vsftpd
[ OK ]
ubuntu@ubuntu:/etc/apt#
```

And now you can use the common FTP client software like Filezilla to FTP files into the user home directory.

6.11 Time and RTC

Users can use date command to set the system runtime clock.

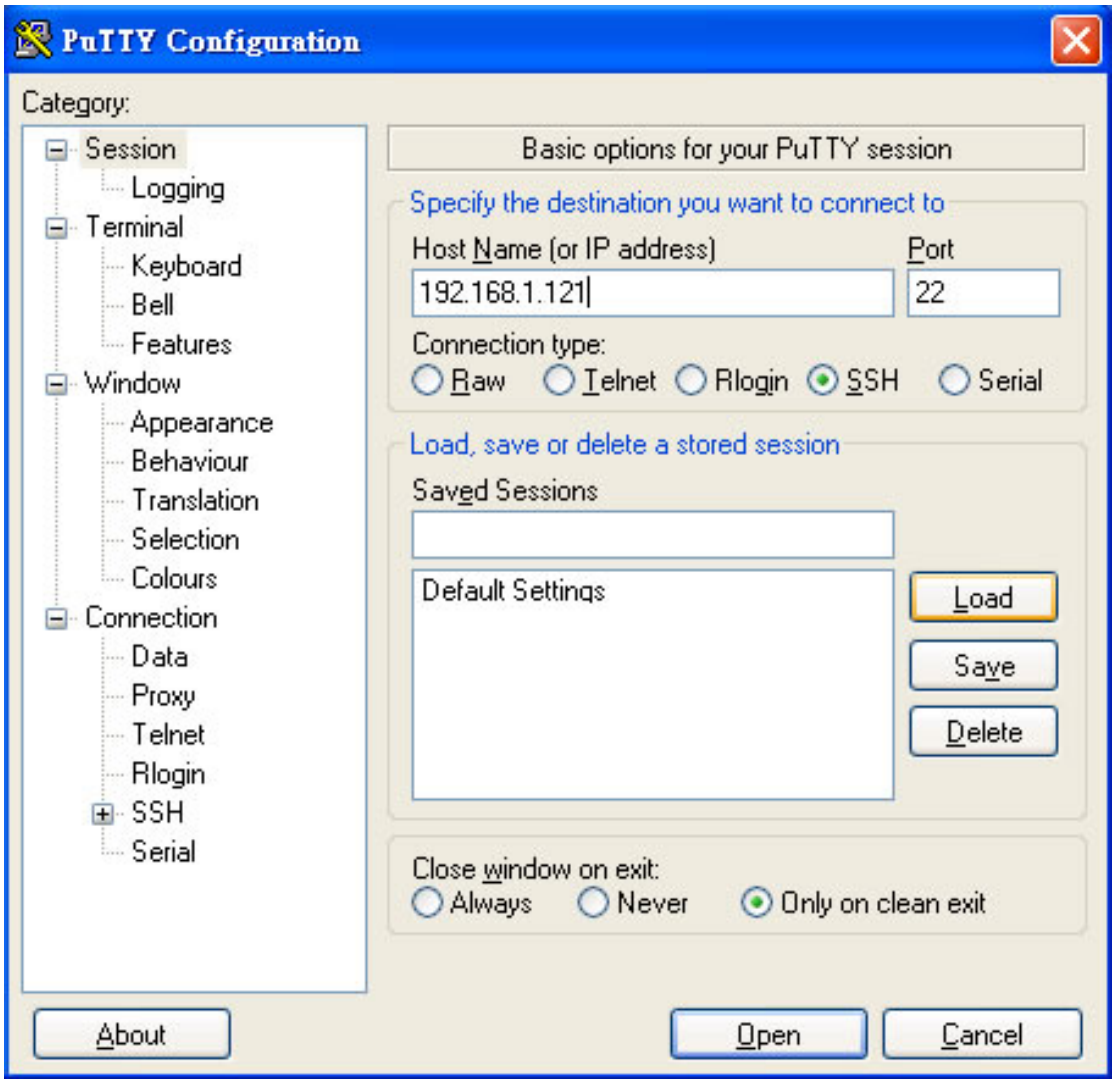
```
# date MMDDhhmmYY
```

The system clock will be restored to default at next reboot. To save the system into hardware, use the following command.

```
ubuntu@ubuntu:~# date 011315362002
Sun Jan 13 15:36:00 CST 2002
ubuntu@ubuntu:~# hwclock --systohc
root@ubuntu:~#
```

6.12 Telnet/SSH Server

The telnet and ssh server are default included in the root file system. You can telnet or ssh to the device from a remote telnet/ssh client such as putty.


PuTTY Configuration
Category:
Session
Logging
Terminal
Keyboard
Bell
Features
Window
Appearance
Behaviour
Translation
Selection
Colours
Connection
Data
Proxy
Telnet
Rlogin
SSH
Serial
Basic options for your PuTTY session
Specify the destination you want to connect to
Host Name (or IP address)
Port
192.168.1.121
22
Connection type:
Raw
Telnet
Rlogin
SSH
Serial
Load, save or delete a stored session
Saved Sessions
Default Settings
Load
Save
Delete
Close window on exit:
Always
Never
Only on clean exit
About
Open
Cancel

Click *Open* to login and you will see the following screen.

```
login as: root
root@192.168.1.121's password:
Linux ubuntu 2.6.24.2 #191 PREEMPT Fri Oct 23 00:30:52 CDT 2009 armv61

The programs included with the Ubuntu system are free software;
the exact distribution terms for each program are described in the
individual files in /usr/share/doc/*/copyright.

Ubuntu comes with ABSOLUTELY NO WARRANTY, to the extent permitted by
applicable law.

To access official Ubuntu documentation, please visit:
http://help.ubuntu.com/
Last login: Tue Oct  1 07:20:26 2013
root@ubuntu:~#
```

6.13 VNC Server

The VNC server allows users to see the desktop of an APC-6410 based remote device and control it with your local mouse and keyboard and without attaching an LCD to the device, just like you would do it sitting in the front of that APC-6410 based device.

First of all you need to install the tightVNC server first.

```
ubuntu@ubuntu:~# sudo apt-get install tightvncserver
```

Now you can start vncserver to have a new display (called :1)

```
ubuntu@ubuntu:~$ sudo vncserver -geometry 800x480

You will require a password to access your desktops.

Password:
Verify:
Would you like to enter a view-only password (y/n)? n
xauth:  creating new authority file /home/ubuntu/.Xauthority

New ' X'  desktop is ubuntu:1

Creating default startup script /home/ubuntu/.vnc/xstartup
Starting applications specified in /home/ubuntu/.vnc/xstartup
Log file is /home/ubuntu/.vnc/ubuntu:1.log

ubuntu@ubuntu:~$
```

It will create .vnc directory under /root. It also will ask you a password (insert it twice) and for the viewing password answer NO.

Now it's time to stop it for few more configurations.

```
ubuntu@ubuntu:~$ sudo vncserver -kill :1
Killing Xtightvnc process ID 2527
ubuntu@ubuntu:~$
```

and move to the configuration files

```
ubuntu@ubuntu:~$ sudo vim /home/ubuntu/.vnc/xstartup
```

commenting out everything and insert the following two lines:

- *openbox &*
- *lxsession*

```
 #xrdb $HOME/.Xresources
#xsetroot -solid grey
#x-terminal-emulator -geometry 80x24+10+10 -ls -title "$VNCDESKTOP
Desktop" &
#x-window-manager &
#/etc/X11/Xsession
openbox &
lxsession
```

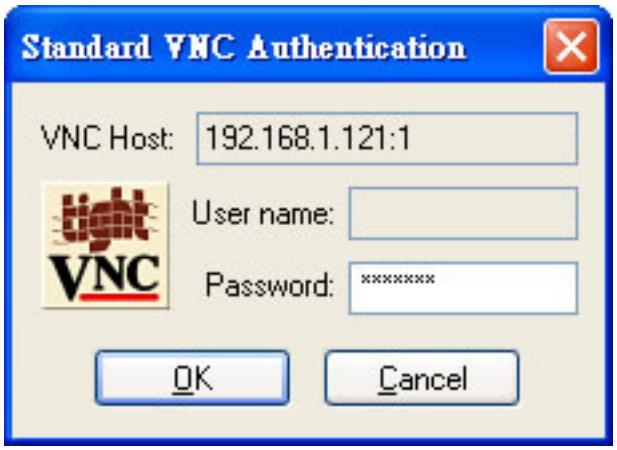
And now you can start vncserver again.

```
ubuntu@ubuntu:~$ sudo vncserver -geometry 800x480

New ' X'  desktop is ubuntu:1

Starting applications specified in /home/ubuntu/.vnc/xstartup
Log file is /home/ubuntu/.vnc/ubuntu:1.log

ubuntu@ubuntu:~$
```

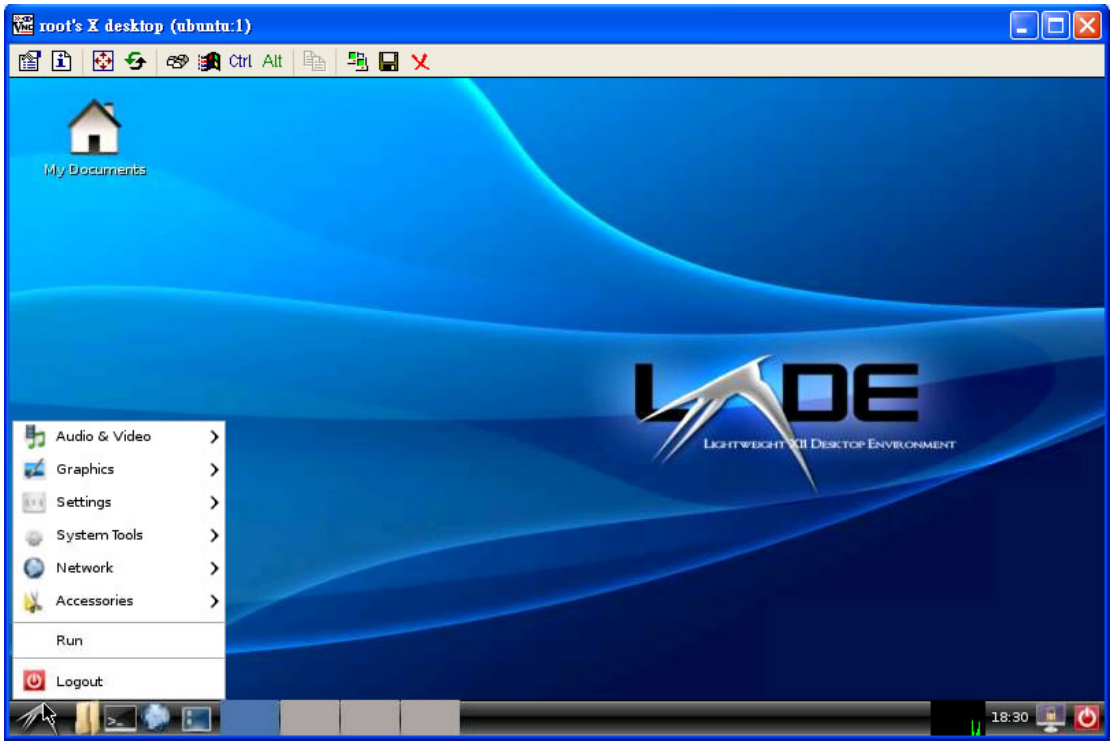
At the Windows XP client side, you can download the free VNC viewer from http://www.tightvnc.com/download.php

Open up the vncviewer program

Click “Connect” and it will pop out a password authentication window. Enter the password.



Click “OK” and you will the device desktop on the remote client side.



To kill the VNC service,

```
ubuntu@ubuntu:~$ sudo vncserver -kill :1
Killing Xtightvnc process ID 4326
ubuntu@ubuntu:~$
```

6.14 GDM

Embedian APC-6410 uses GDM Gnome Display Manager) as the graphical login program. GDM is the GNOME Display Manager, a graphical login program that uses XWindow.

GDM provides the equivalent of a "login:" prompt for X displays- it pops up a login window and starts an X session.

It provides all the functionality of xdm, including XDMCP support for managing remote displays.

To stop the gdm service, you can use the command

```
ubuntu@ubuntu:~$ sudo /etc/init.d/gdm stop
```

You can use gdm to load different desktop environments and Window Mangers. Because of the memory limitation, the default is using the LXDE system. If users would like to consider GNOME, the 256MB DDR RAM is the minimum requirement.

6.15 LXDE

Because of the memory limitation, Embedian chooses LXDE as default desktop environment. After login into the GDM display manager, the GDM will launch LXDE directly by default.

LXDE, *Lightweight X11 Desktop Environment*, is a desktop environment which is lightweight and fast. It is designed to be user friendly and slim, and keep the resource usage low. LXDE uses less RAM and less CPU while being a feature rich operating system. Because of the low usage of resources it also saves energy. We don't tightly integrate every component of LXDE. Instead, we try to make all components independent, so each of them can be used independently with few dependencies. More about LXDE on the lxde.org website, theLXDE blogs, and in the LXDE forum.

LXDE Components

- PCManFM, is a fast and lightweight file manager with features like Drag & Drop support, tabbed browsing (Similiar to Firefox), Built-in file searching utility, fast load of large directories, File association support (Default application), Thumbnail for image files, Bookmarks support,

correct handling of non-UTF-8 encoded filenames and more.

- LXLauncher, easy-mode application launcher
- LXPanel, desktop panel, the panel can generate menu for installed applications automatically from *.desktop files. It can be configured from GUI preference dialog, and there is no need to edit config files. The component provides a "Run" dialog with autocompletion.

- LXSession, session manager, The LXSession manager is used to automatically start a set of applications and set up a working desktop environment. Moreover, the session manager is able to remember the applications in use when a user logs out and to restart them the next time the user logs in.
- LXSession Edit, window manager used in LXDE can be changed, ability to turn on disabled applications
- LXAppearance, theme switcher. You can change the theme, icons, and fonts used by applications easily.
- Leafpad, text editor
- Xarchiver, archiving
- GPicView, image viewer, GPicView features lightening fast startup and intuitive interface.
- LXTerminal, terminal emulator
- LXTask, task manager / system monitor
- LXNM, lightweight network connection helper daemon for LXDE supporting wireless connections (Linux-only)
- Openbox, window manager and obconf
- LXRandr, screen manager, manages screen resolution and external monitors
- LXShortCut, an easy way to edit application shortcuts
- LXMusic, minimalist xmms2-based music player
- LXDE Common, the default settings configuration file for integrating the different components of LXDE. LXDE Common manages the system behavior and functions to integrate icons and artwork.
- GtkNetCat, Graphic User Interface for netcat. Netcat provides system functions as a computer networking utility for reading from and writing to network connections on either TCP or UDP.

Embedian Add-on Components

- ***GMplayer***, is the GUI of Mplayer. It is integrated by Embedian to support the hardware MFC from CPU. Details can be found at section 6.14 and Chapter 7.
- ***Calibrate TouchScreen***, is a tool to calibrate the touch screen.

6.16 Calibration and Touch Screen

Some applications use touch panel as input device. If that is the case, users need to install the calibration program that Embedian provided first.

6.16.1 Install the Calibration Program

Change directory to /tmp first and copy the "*ts_upgrade.tar.gz*" file into the device and extract it as shown below.

```
ubuntu@ubuntu:~# cd /tmp
ubuntu@ubuntu:/tmp# ls
ubuntu@ubuntu:/tmp# lftp eric@59.124.115.45
Password:
lftp eric@59.124.115.45:~> get ts_upgrade.tar.gz
580432 bytes transferred
lftp eric@59.124.115.45:~> bye
ubuntu@ubuntu:/tmp# ls
ts_upgrade.tar.gz
ubuntu@ubuntu:/tmp#
```

Extract this tarball and execute the shell script as follows.

```
ubuntu@ubuntu:/tmp# tar xvfz ts_upgrade.tar.gz
embedian-mxm6410-touchscreen.deb
install.sh
ubuntu@ubuntu:/tmp# ./install.sh
Reading package lists... Done
Building dependency tree
Reading state information... Done
```

Reboot, and you will see the calibration program on the screen. There are five cross points for users to calibrate. The calibration value will be stored in the NAND flash after calibrated. APC-6410 will check if this calibration value

exists there or not at next boot. If yes, users will not need to calibrate every time.

Note:

Users need to connect a touch screen to APC-6410 when install this package, or the boot up process will stop at the following boot up process to wait you input the calibration value.

```
* Starting OpenBSD Secure Shell server sshd                    [ OK ]
 * Starting Hardware abstraction layer hald                    [ OK ]
```

After calibration, it will bring you to the gdm login screen. To re-calibrate, users can use the following command line.

```
ubuntu@ubuntu:~# sudo ts_calibrate
```

Or pending at the touch screen for a while when booting.

The device will only ask you calibrate at first boot. After the first calibration, the calibration value will be stored. And the next boot will check if this value existing or not. If yes, the device will just use this value.

6.17 Kiosk Mode

6.17.1 Boot Ubuntu 9.04 into text mode instead of graphic mode

Some users' applications are relatively simple and they develop their GUIs directly on top of frame buffer (*/dev/fb0*). They don't even need X11 running on the device. Or some server applications don't need to have a graphic interface at all. To boot into text mode or to disable a service (such as GDM) from being started in a given runlevel (e.g., 2 which is Ubuntu's default runlevel) is like so:

```
ubuntu@ubuntu:~# sudo /etc/rc2.d/S30gdm /etc/rc2.d/K70gdm
ubuntu@ubuntu:~# sudo shutdown now -r
```

After reboot, you will see the text mode booting into the LCD screen. You can reverse this file back to boot into graphic mode again.

If you would like launch the, for example, *mplayer* application under the text mode, you can

```
ubuntu@ubuntu:~# mplayer -quiet -fs -vo fbdev test.avi
```

And you can write a simple script to let this program to startup automatically at boot.

If you would like to stop the X11 and X application at runtime, you can

```
ubuntu@ubuntu:~$ sudo /etc/init.d/gdm stop
[sudo] password for ubuntu:
 * Stopping GNOME Display Manager...
[ OK ]
ubuntu@ubuntu:~$
```

To make your services startup at boot, Ubuntu Linux use *update-rc.d* command to install and remove System-V style init script links. Let us take the *mysql* service for example.

Turn on or start service called *mysql* on boot

```
ubuntu@ubuntu:/etc$ sudo update-rc.d mysql defaults
```

Remove service called *mysql* on boot:

```
ubuntu@ubuntu:/etc$ sudo update-rc.d mysql remove
```

OR

```
ubuntu@ubuntu:/etc$ sudo update-rc.d -f mysql remove
```

Replace *mysql* name with actual service name.

Note:

It is not recommended to boot into text mode by using *update-rc.d remove* and *update-rc.d defaults*. “update-rc.d foo defaults” will not put “foo” back into its previous start-up slot, but puts it at S20 by braindead “default”. It’s the oldest surviving bug in UNIX history. For gdm this can cause real grief because it puts it before processes that should have completed start-up before gdm goes about its merry ways.

6.17.2 GDM Auto Login

To allow Ubuntu GDM Auto Login, you need edit gdm.conf and add the user you want to auto login. Let’s assume the user that you would like to auto

login is *ubuntu*.

```
ubuntu@ubuntu:~$ sudo vim /etc/gdm/gdm.conf
```

At line 48, 49

```
AutomaticLoginEnable=true
AutomaticLogin=ubuntu
```

Reboot the device will automatically login into the lxde desktop.

6.17.3 Auto Start a Program under LXDE

To auto start a program under LXDE, users can edit */etc/xdg/lxsession/LXDE/autostart* file and add the program that you would like to auto start at the end of this file. Let's take the *firefox* program for example.

```
@lxde-settings
@xscreensaver -no-splash
@lxpanel --profile LXDE
@pcmanfm -d
@firefox -width 800 -height 480
```

After reboot, you will see the Firefox program auto start at the top of the panel.

Note:

If users don't even need LXDE to auto start the program, you will need to modify the */etc/alternatives/x-session-manager* to auto start the program and comment out the LXDE auto start script.

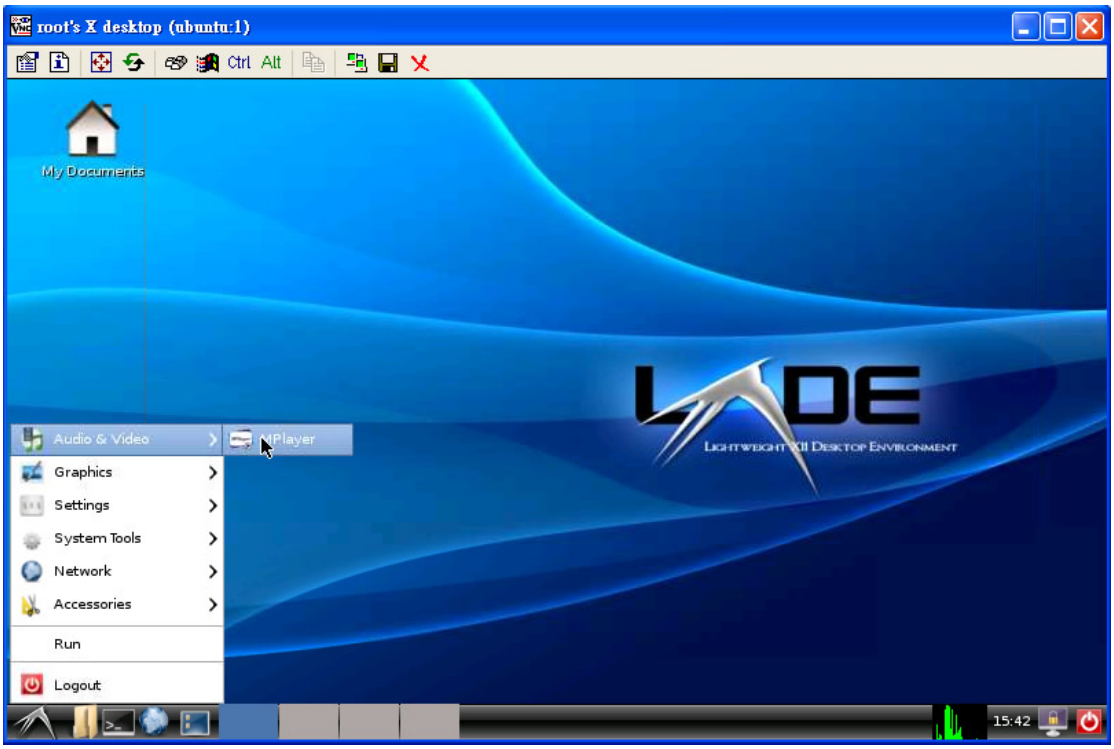
6.18. MPEG4 Decoder for Mplayer at Device

Embedian integrates the CPU MFC hardware codec into Mplayer and natively supports MPEG4 DivX ***DX50*** and MPEG4 ***Xvid*** standard. Any video files that generated by a software encoder that supports these standards can be

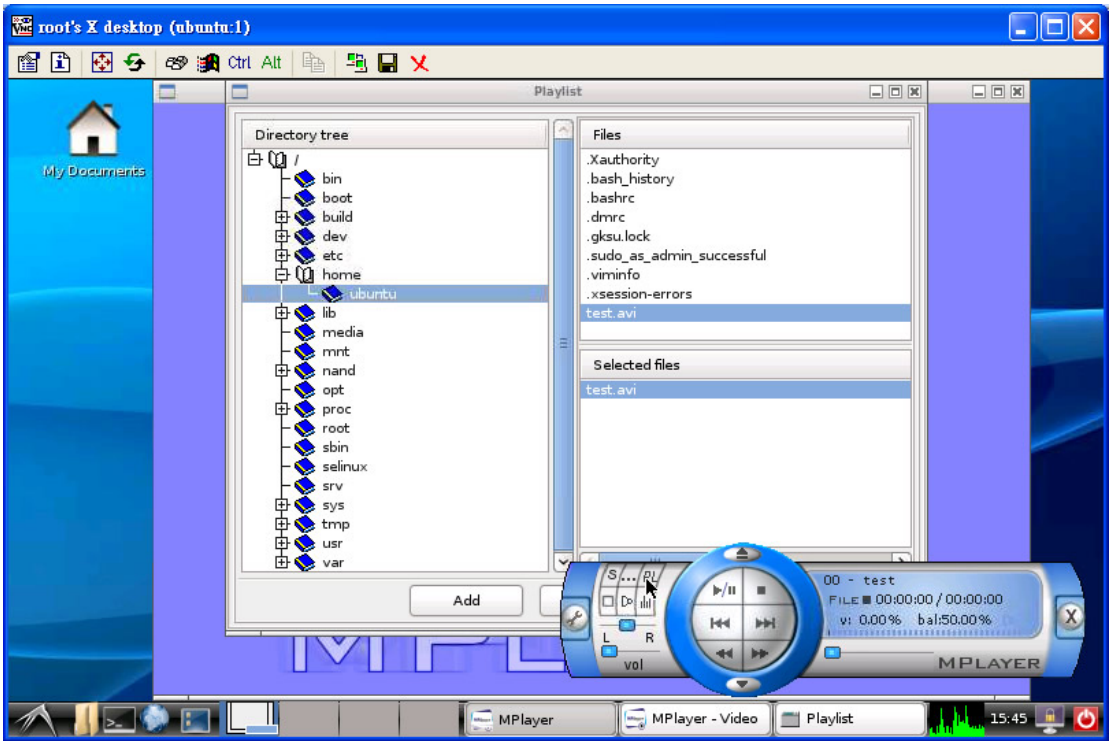
decoded by the hardware decoder supported Mplayer.

6.18.1. Mplayer running on top of GDM and LXDE

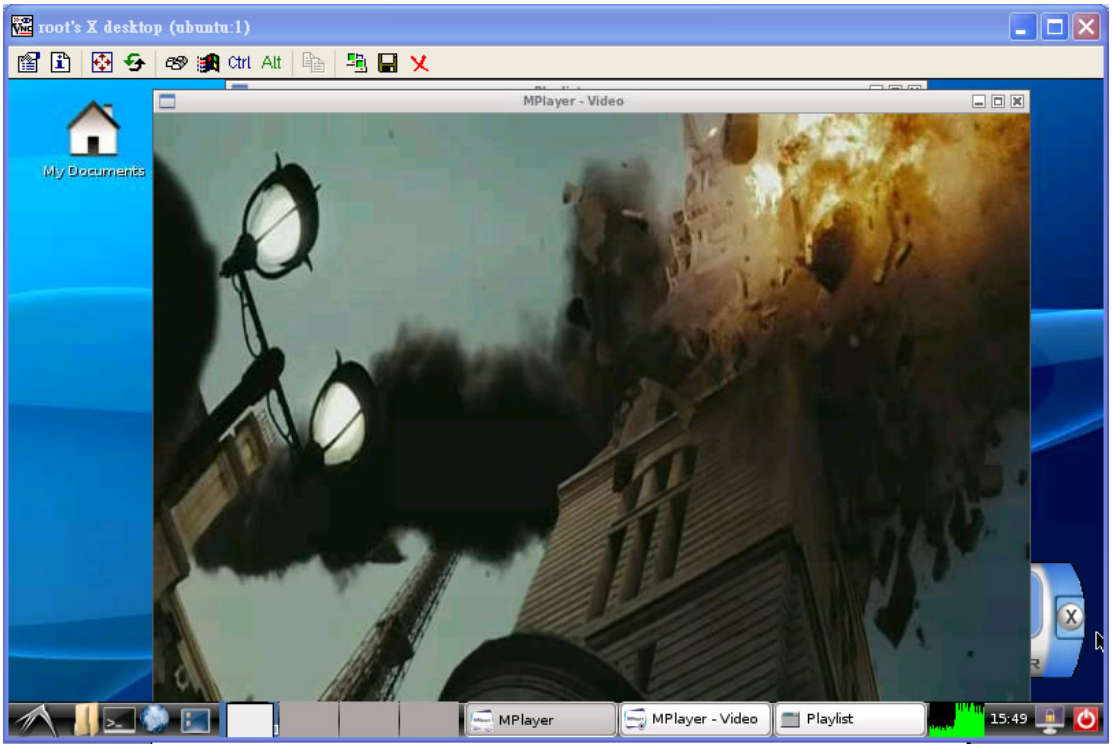
At “Start” → “Audio & Video”, Click “Mplayer”



Add the file to the play list,



Click the triangle sign on panel to play the video.



6.18.2. Mplayer Running on top of frambuffer directly

The previous example of Mplayer is running on top of X. Mplayer can also be played directly on top of frame buffer. If that is the case,

```
ubuntu@ubuntu:~$ sudo /etc/init.d/gdm stop
[sudo] password for ubuntu:
 * Stopping GNOME Display Manager...
[ OK ]
ubuntu@ubuntu:~# mplayer -quiet -fs -vo fbdev test.avi
```

Note:

-quite parameter is highly recommended.

-fs means full screen

-vo to *fbdev* means to show video on top of frame buffer directly.

6.19 NAND Root File System

The *linuxrc* file in the NAND flash determines where the root file system should boot into. This section mainly introduces the NAND file system.

6.19.1 linuxrc

The *linuxrc* is a program that is started in the start-up stage of the kernel prior to the actual boot process. This allows you to boot a small modularized kernel and to load the few drivers that are really needed as modules. *linuxrc* assists in loading relevant drivers manually.

The use of *linuxrc* provides with the choices to boot into a small root file system in NAND or the Ubuntu 9.04 system in SD card. (If no press anything, the default is set to boot into SD card.)

The *linuxrc* file is located in the NAND flash. User can edit it if they purely want to use NAND flash as their main root file system. There are two ways to access *linuxrc*.

First, if user boot into SD Ubuntu file systems, the NAND flash will be mounted automatically. And user can just access the file that is located at */nand* directory.

```
ubuntu@ubuntu:~$ cd /nand
ubuntu@ubuntu:/nand$ ls
bin  etc  linuxrc     mnt   root  selinux  tmp  var
dev  lib  lost+found  proc  sbin  sys      usr
```

```
ubuntu@ubuntu:/nand$
```

Second, users can boot in NAND flash first by pressing *2) NAND* during the booting process. (The root pass is ***apc7110*** by default.) The *linuxrc* file is located at / directory. The NAND file system is also an EXT3 file system. Users can edit the file just you do in any Linux PC.

```
apc7110 login: root
[root@apc7110 /]# ls
bin  etc  linuxrc     mnt   root  selinux  tmp  var
dev  lib  lost+found  proc  sbin  sys      usr
[root@apc7110 /]#
```

6.19.2 As a rescue file system

The NAND file system can play a role of rescue file system, especially when the main Ubuntu file system is corrupted or cannot boot into for some reason. Here we would like to give you a guide to restore the SD Ubuntu file system from NAND file system.

1. Boot into NAND flash first by pressing *2) NAND* during booting process and login as *root* privilege. (The root pass is ***apc7110*** by default.)
2. Prepare for a at least 1GB SD/SDHC card. The SDHC card will have better read/write performance, but usually the SDHC card is at least 4GB.
3. The NAND file system will mount partition 1 of SD card by default (The device descriptor of SD device is */dev/mmc0,* and the partition 1 of SD card is */dev/mmc1*). Here would like to format the partition 1 of SD card as EXT3 first.

```
  [root@apc7110 /]# mkfs -t ext3 /dev/mmc1
mke2fs 1.37 (21-Mar-2005)
Filesystem label=
OS type: Linux
Block size=4096 (log=2)
Fragment size=4096 (log=2)
488640 inodes, 977263 blocks
```

```
48863 blocks (5.00%) reserved for the super user
First data block=0
30 block groups
32768 blocks per group, 32768 fragments per group
16288 inodes per group
Superblock backups stored on blocks:
        32768, 98304, 163840, 229376, 294912, 819200, 884736

Writing inode tables: done
Creating journal (8192 blocks): done
Writing superblocks and filesystem accounting information: done

This filesystem will be automatically checked every 38 mounts or
180 days, whichever comes first.  Use tune2fs -c or -i to override.
[root@apc7110 /]#
```

4. Mount the partition 1 of the SD card as */mnt* and *cd* to */mnt* directory

```
 [root@apc7110 /]# mount -t ext3 /dev/mmc1 /mnt
kjournald starting.  Commit interval 5 seconds
EXT3 FS on hda1, internal journal
EXT3-fs: mounted filesystem with ordered data mode.
[root@apc7110 /]# cd /mnt
[root@apc7110 /mnt]#
```

5. Ftp the rootfs tarball into this directory. Let's assume that the root file system is located at 192.168.1.10 ftp server.

```
 [root@apc7110 /mnt]# ftp 192.168.1.10
Connected to 192.168.1.10.
220 (vsFTPd 2.2.2)
Name (192.168.1.10:root): eric
331 Please specify the password.
Password:
230 Login successful.
Remote system type is UNIX.
Using binary mode to transfer files.
ftp> get u904.090930.tar.gz
200 PORT command successful. Consider using PASV.
```

```
150 Opening BINARY mode data connection for u904.090930.tar.gz (219759103
bytes).
226 Transfer complete.
219759103 bytes received in 77.1 seconds (3124731 bytes/s)
ftp>
```

6. Extract this tarball (You might need to set the system time by *date* command first.)

```
[root@apc7110 /mnt]# tar xvfz u904.090930.tar.gz
```

7. remove the tarball and exit to */mn*t directory

```
[root@apc7110 /mnt]# rm u904.090930.tar.gz
[root@apc7110 /mnt]# cd ../
```

8. *umount /mnt*

```
[root@apc7110 /]# umount /mnt
[root@apc7110 /]#
```

9. *Reboot*

```
[root@apc7110 /mnt]# cd ../
[root@apc7110 /]# umount /mnt
[root@apc7110 /]# shutdown now -r
Why?
```

You will see the gdm login screen appear on the LCD screen.

6.19.3 As a small root file system

At development stage, it is recommended that user develop their program under SD Ubuntu root file system. Users can *apt-get install gcc* and use *gcc* to do natively make first. After development work done, you can copy the new binary files to NAND flash and do the test again. And then modify the *linuxrc* to boot into NAND flash only.

The other alternative is to use the cross compiler to develop your application at PC. After you done the development, you can ftp the program into the NAND flash and make a test. You can also do this way when developing

your program at SD Ubuntu file system.

6.20 Cross Toolchain

For kernel compile, since it doesn't rely on any libraries and is totally independent, we do suggest use this cross-compile tool that could save lots of time, and no problem at all for applications.
For applications, we do suggest you switch to native compile mode since the host pc which used to make the s/w doesn't know the s/w environment of target platform. User can get the gcc 4.2 at device from Ubuntu repository by

```
ubuntu@ubuntu:~$ sudo apt-get install gcc
```

IF YOU ARE USING UBUNTU ROOTFS, WE STRONGLY SUGGEST USE NATIVE COMPILE MODE, at least, at the final stage of test.
The crosss toolchain version that we are using is 4.2.2 with EABI supported. The file name is cross-4.2.2-eabi.tar.bz2 that can be downloaded from Embedian FTP site.

6.20.1 Installing Toolchain

Building the tool chain is not a trivial exercise and for most common situations pre-built tool chains already exists. Unless you need to build your own, or you want to do it anyway to gain a deeper understanding, then simply installing and using a suitable ready-made tool chain is strongly recommended.
Please follow the commands below and install the toolchain in the directory mentioned below:

 # mkdir –p /usr/local/arm
 # tar jxvf cross-4.2.2.-eabi.tar.bz2

The above command will generate the ***4.2.2-eabi*** folder under the same directory as you made the commands. Move this folder to ***/usr/local/arm*** directory.

 # mv 4.2.2-eabi /usr/local/arm/
 # export PATH=$PATH:/usr/local/arm/4.2.2-eabi/bin

As of now, you have installed the cross toolchain into your Linux PC.
At your application that you would like to cross complied, you need to modify the *Makefile* and point the CROSS_COMPILE to

CROSS_COMPILE = /usr/local/arm/4.2.2-eabi/bin/arm-linux-

6.20.2 Build Uboot

1. # Extract *u-boot-6410_090930.tar.gz* file.
2. # *make clean*
3. # *make smdk6410_config*
4. # *make*

See firmware update section for firmware update. Unless necessary, we do not recommend you flash bootloader. It might cause to boot failure.

6.20.3 kernel zImage

1. Extract Linux source code *linux-2.6.21-04132009.tar.bz2* that released from Embedian
2. # # *tar xvfj linux-2.6.21-04132009.tar.bz2*
3. # *cd linux-2.6.21*
4. # *gzip -d -c ../ patch-04032009-0056.gz | patch -p0*
5. # *make mxm6410_defconfig*

Using Windows CE 6.0

This Chapter details how to use the Windows CE 6.0 of APC-6410 single board computer.
Section include：

- EBOOT
- Windows CE 6.0
- Configure LCD parameters for different kinds of LCDs

Chapter 7 Using Windows CE 6.0

This Chapter gives an overall guide in regarding to the Windows CE 6.0 features and how to use the Windows CE 6.0 system that Embedian provided with for APC-6410 single board computer. The first is to introduce the general features. Next, we will introduce EBOOT menu configuration and the third part is to introduce the Windows CE 6.0 systems. The last section will teach users how to set the parameters for different kinds of LCDs without re-building from the sources or PB (Platform Builder).

Before going on, users need to install the “wceusbsh” USB drivers that Embedian provided with on your Windows PC first. It is the Windows CE USB RNDIS driver that is required for active sync. (When plug the USB cable to the Windows PC at first time, Windows will ask you to install the driver. Just point to the directory where your USB driver placed and the installation will be done.) Connect the console port (UART0, CN20) to your Windows PC first. Make sure that the jumpers are properly configured.

7.1 General Features

7.1.1 Board Support Package (BSP)

The Embedian Board Support Package for Windows CE 6.0 is one of the most advanced BSPs available on the market. Beside the standard Windows CE functionality, it includes a large number of additional drivers as well as optimized versions of standard drivers.

The Embedian bootloader and BSP were designed to be very configurable. This relieves the application-developer from the burden of creating an own image. Instead the necessary adaptations can be done by registry settings and adding files to the on-board flash file system.

The BSP is available at Embedian FTP site at

ftp://ftp.embedian.com/pub/MXM-6410/WINCE60/.

Customers who follow the readme instruction in the BSP folder for Microsoft's Platform Builder will enable you to build exactly the same Windows CE image as Embedian provides by default.

7.1.2 Drivers

The Embedian Board Support Package for Windows CE 6.0 is one of the most advanced BSPs available on the market. Beside the standard Windows CE function

The following drivers are integrated in the standard image that comes pre-installed with each APC-6410 board.

Table 7.1.1 Drivers

Table 7.1.1	***Drivers***
Driver	*Description*
COM1	*Support RXD/TXD/CTS/RTS*
COM2	*Support RXD/TXD*
COM3	*Support RXD/TXD*
COM4	*External UART that supports the full RS232 specification with all 9 signals.*
COM5	*External UART that supports the full RS232 specification with all 9 signals.*
Ethernet	*10/100Mbit driver for Davicom DM9000B*
USB Host	*4 Ports supporting mass storage devices (USB-stick, hard disc, CD-ROM…) and other devices as keyboard, mouse, USB hub…*
USB OTG	*Can be used as ActiveSync connection, mass storage or RNDIS*
Audio	*16Bit stereo output (up to 48kHz), mic input, line-In*
Touch Screen	*All 4-wire resistive screens supported*
Display	*All types of displays supported. Easy configuration in EBOOT*
SD/SDHC	*Memory cards, Wireless LAN, Bluetooth, GSM, GPS …*
CF	*Memory cards, Wireless LAN, modem, Bluetooth, serial card, GPS, GSM, …*
GPIO	*12 Configurable GPIO with Sample codes. Easy configuration at Eboot and NK*
Flash File System	*HIVE-based registry. Standard FAT as well as TFAT (transaction safe FAT) are supported*
2D Engine	*CPU 2D acceleration h/w supported*
3D Engine	*Support CPU 3D h/w acceleration. Support OpenGLES 1.1/2.0 and follow the Khronos naming rules*
TV-Out	*TV output driver for NTSC/PAL format is supported*
Camera	*Camera drivers for various camera modules*
MFC Engine	*Support h/w H.263, H.264, VC1*
SPI	*High speed SPI supported*
RTC	*Real time clock driver*

7.1.3 Services

The following services are integrated in the standard image that comes pre-installed with each APC-6410 board. User can add their application oriented service from the BSP as well.

Table 7.1.2 Services

Table 7.1.2	***Services***
Service	***Description***
FTP Server	*Access device using the FTP File Transfer Protocol*
Telnet Server	*Access device using the Telnet protocol*
HTTP Server	*Access device using the HTTP protocol*
File Server	*Access device using the Samba protocol*
Time Server / Client	*Synchronize time with the network using the NTP protocol*
Shell	*Allow APC-6410 to run batch file*

7.1.4 Special Features

In addition to the standard Windows CE functionality, Embedian has extended the operating system by following features:

Table 7.1.3 Special Features

Table 7.1.3	***Special Features***
Special Features	***Description***
EBOOT	*Configuration through RS232/USB, clear flash registry, download image to RAM, download image to Flash, format flash, set/save configured structures, define initial GPIO configuration and set LCD parameters.* *Debug Functionality: erases flash range, write/read 32bit value at address.*
Direct SD Boot	*Boot Directly from SD card. It is very useful for maintenance purposes.*
LCD Customizer	*Set all types of LCD resolution parameters in EBOOT and pass to NK.*
Splash Screen	*Display default start-up screen while Windows CE is booting.*

ActiveSync	*Support Microsoft Active Sync. via USB 2.0 or serial port*
Hive-Based Rigistry	*Support Hive-Based Registry*
AutoStart	*Automatically execute programs upon system boot or upon removable media insertion*
AutoCopy	*Automatically copy files to the RAM file system upon system boot or upon removable media insertion. This, for example, can be used to add items to the Windows CE START menu button.*
GPIO Customizer	*Each GPIO can be configured to act as input, output, high, low or an interrupt source at EBOOT and NK.*
Flushing Registry on Changes	*Registry will be saved to Flash immediately on changes. Registry will be kept anytime even when power failure.*
SplashScreen Customizer	*Show your own screen while Windows CE is booting*
NAND Flash Writer	*To recover the firmware in NAND flash from NOR flash or SD by jumper setting.*
Registry Editor	*To edit registry locally or remotely*
Remote Display	*To see device desktop and control it without panel attached*

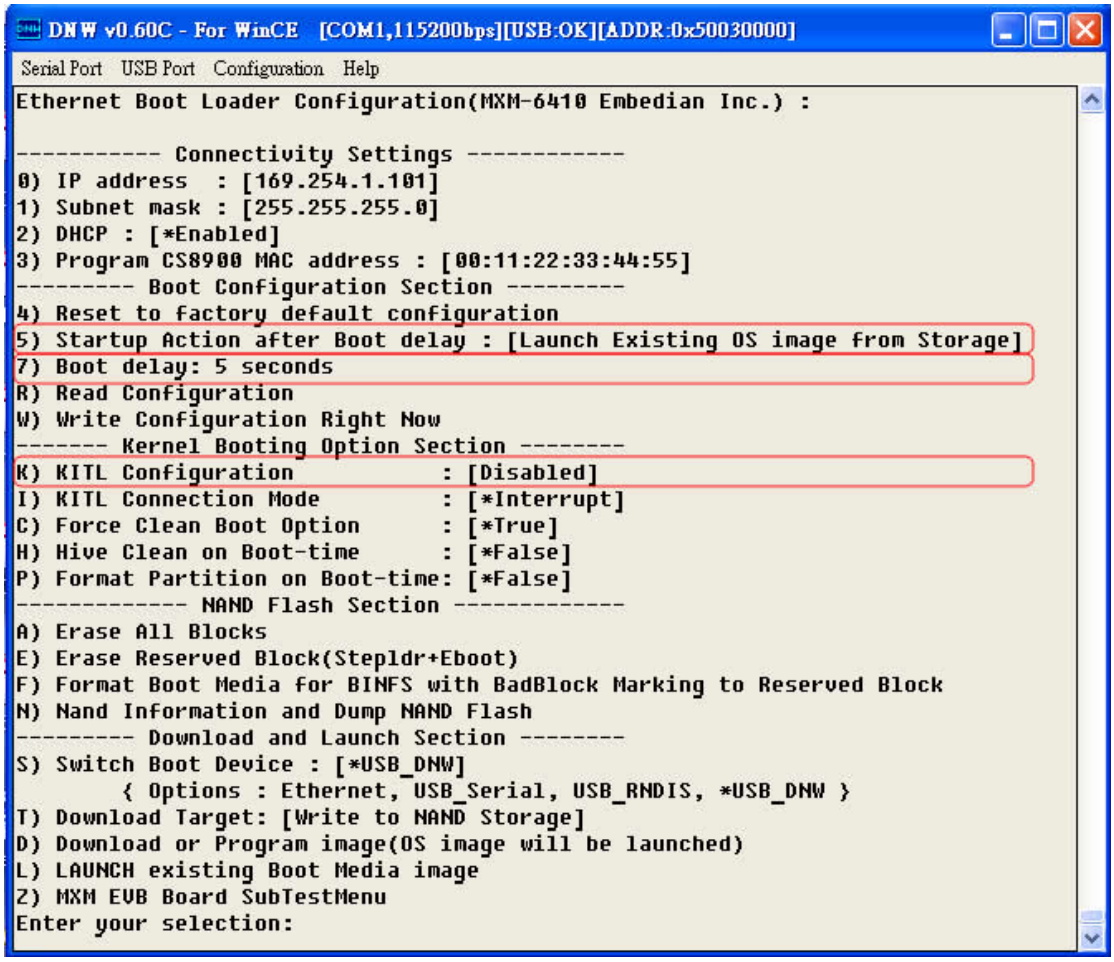
7.2 EBOOT

Turn on the power of the device. You should be able to hear a short beep. If you attached an LCD to the device, you will be able to see the splash screen as in figure 7.2.1.

Figure 7.2.1 EBOOT Splash Screen

To enter EBOOT menu configuration, press [**Space**] bar of your keyboard when booting. And you will see the following screen as shown in figure 7.2.2.

Figure 7.2.2 EBOOT Menu Configurations


DNW v0.60C - For WinCE [COM1,115200bps][USB:OK][ADDR:0x50030000]
Serial Port USB Port Configuration Help
Ethernet Boot Loader Configuration(MXM-6410 Embedian Inc.) :
---------- Connectivity Settings ----------
0) IP address : [169.254.1.101]
1) Subnet mask : [255.255.255.0]
2) DHCP : [*Enabled]
3) Program CS8900 MAC address : [00:11:22:33:44:55]
--------- Boot Configuration Section ---------
4) Reset to factory default configuration
5) Startup Action after Boot delay : [Launch Existing OS image from Storage]
7) Boot delay: 5 seconds
R) Read Configuration
W) Write Configuration Right Now
------- Kernel Booting Option Section --------
K) KITL Configuration : [Disabled]
I) KITL Connection Mode : [*Interrupt]
C) Force Clean Boot Option : [*True]
H) Hive Clean on Boot-time : [*False]
P) Format Partition on Boot-time: [*False]
------------- NAND Flash Section -------------
A) Erase All Blocks
E) Erase Reserved Block(Stepldr+Eboot)
F) Format Boot Media for BINFS with BadBlock Marking to Reserved Block
N) Nand Information and Dump NAND Flash
--------- Download and Launch Section --------
S) Switch Boot Device : [*USB_DNW]
{ Options : Ethernet, USB_Serial, USB_RNDIS, *USB_DNW }
T) Download Target: [Write to NAND Storage]
D) Download or Program image(OS image will be launched)
L) LAUNCH existing Boot Media image
Z) MXM EVB Board SubTestMenu
Enter your selection:

You need to make sure that the following two items have been configured correctly.

First

Press "**5**" to change from

"5) Startup Action after Boot delay : [*Download New image]"

to

"5) Startup Action after Boot delay : [Launch Existing OS image from Storage]"

This is to tell EBOOT to load the Windows CE 6.0 NK.bin image from NAND flash to DDR RAM.

Second

Press "**K**" to disable the KITL configuration. That is to change from

"K) KITL Configuration : [*Enabled]"

to

"K) KITL Configuration : [Disabled]"

Users can also set up the boot delay interval between EBOOT and NK by pressing "**7**".

Third

Before exit EBOOT menu, remember to press "**W**" to save the new configuration.

The Ethernet connectivity settings in EBOOT menu is for setting the network parameters for Ethernet download images from Platform Builder. User need to choose Ethernet for both download and transport protocols in their PB target connectivity options. And click on the setting button next to download and select the device when it shows up in the "Active Target Devices" window. But Embedian suggests users use USB to download images because of the download speed is faster. The IP address setting here will not be the same as Windows CE 6.0 NK image that is stored as HIVE registry.

After saving the EBOOT configuration by pressing "**W**", users can reset the system or press "**L**" to launch the Windows CE 6.0 NK.bin image from NAND flash.

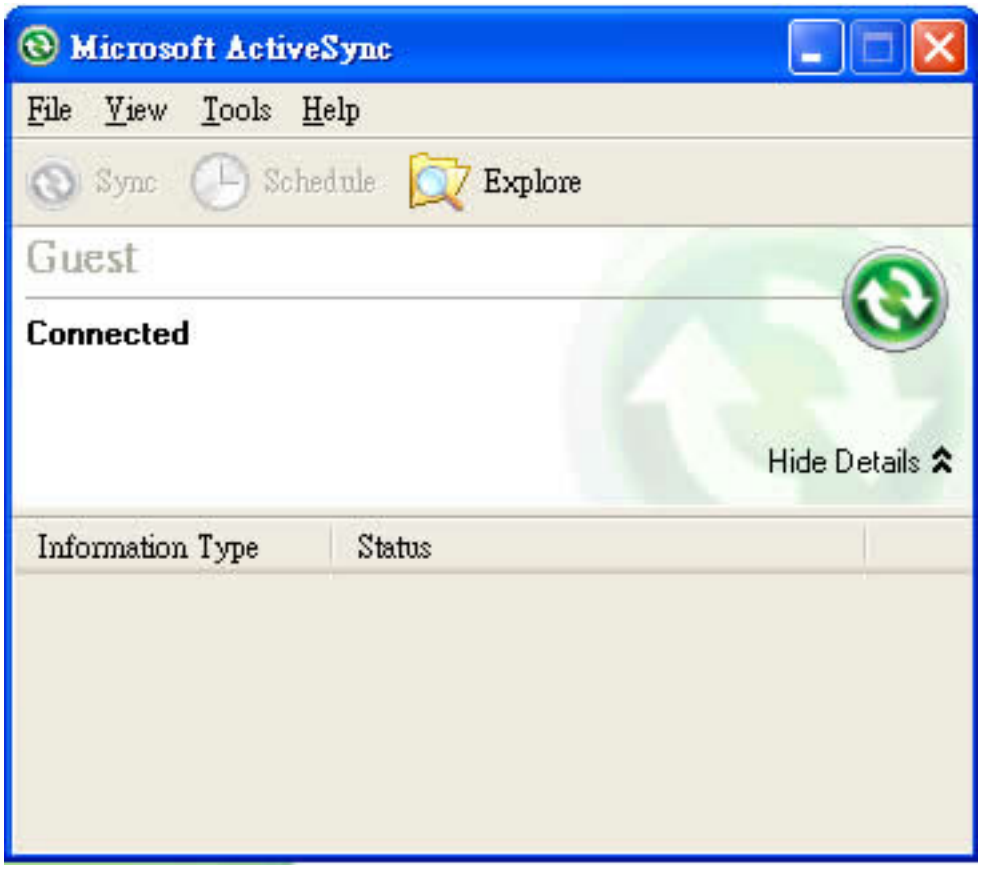
If you have ActiveSync program (user can download this program for free from Microsoft's website) installed in your Windows PC and the USB cable is connected to the device, you should be able to see the ActiveSync program pop out and ask you to set up a partnership during loading the NK image as shown in figure 7.2.3.

Figure 7.2.3 ActiveSync Program

New Partnership
Set Up a Partnership
Before you can synchronize information between your mobile device and this computer, you must set up a partnership between them.
Would you like to set up a partnership?
Yes
Set up a partnership so that I can synchronize information between my device and this computer.
No
I don't want to synchronize information. Set up my device as a guest so that I can copy or move information between my device and this computer.
< 上一步(B)
下一步(N) >
取消
說明

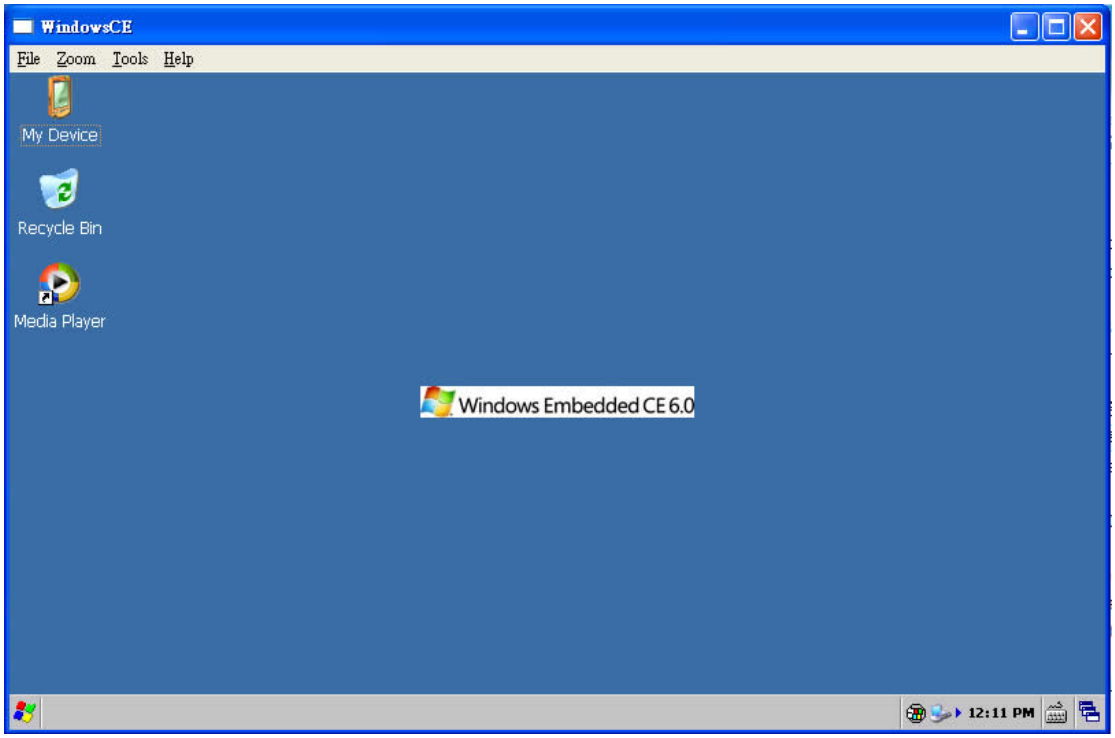
Select "**No**" and click "**Next**" of your ActiveSync program. You will see the screen shown as in figure 7.2.4.

Figure 7.2.4 ActiveSync Program



Users should be able to see the Windows CE 6.0 desktop on the LCD screen or remote tools as shown in figure 7.2.5.

Figure 7.2.5 Windows CE 6.0 Desktop



Next section, we will introduce the Windows CE 6.0 system.

7.3. Windows CE 6.0

This section will introduce the Windows CE 6.0 system.

7.3.1. Setting the System Time

The APC-6410 includes a battery-backed real-time clock.

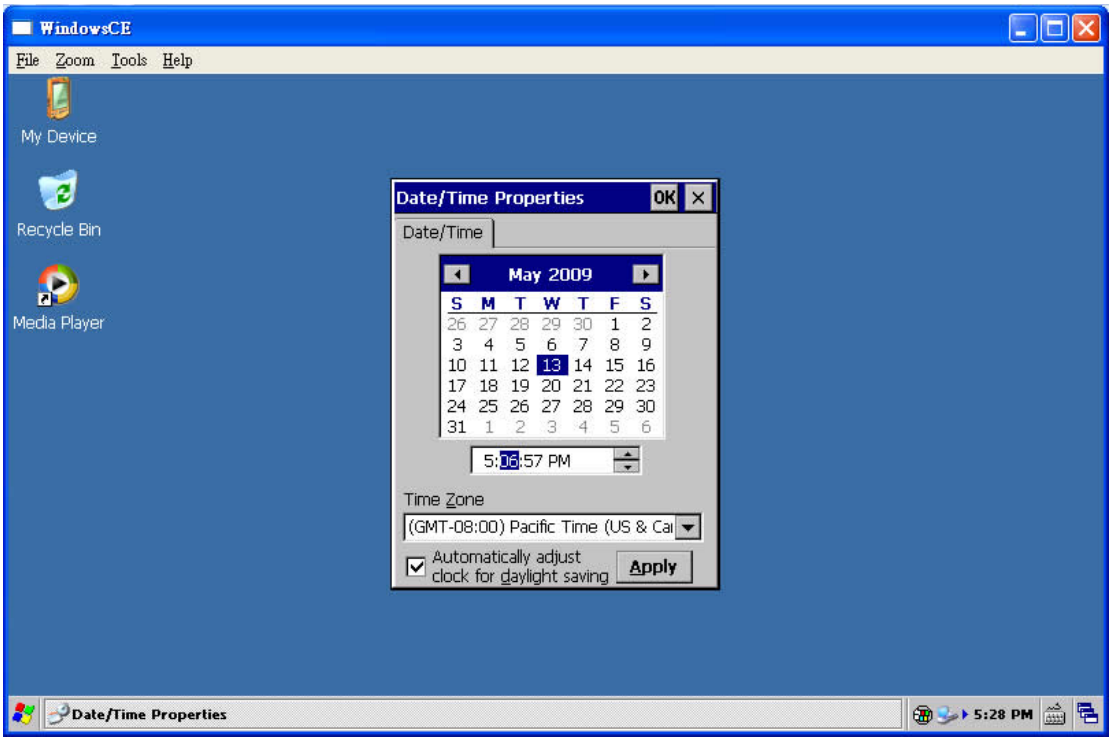
To set the System Time:

1. Double-tap on the time icon at the bottom right of the taskbar (shown below in figure 7.3.1.).

Figure 7.3.1 Windows CE Time Icon

2. Within the Date/Time Properties Dialog (shown below in figure 7.3.1.), set the current date and time then press the OK button to save these settings.

Figure 7.3.2 Date/Time Properties Dialog



APC-6410 comes with a RTC battery pack. When the external DC power is exist, the RTC battery will be charged. And when the external DC power is removed, the RTC battery will supply the RTC to keep the time for few days. It is therefore; users don't have to set up the system time every time when the external DC power is temporarily gone.

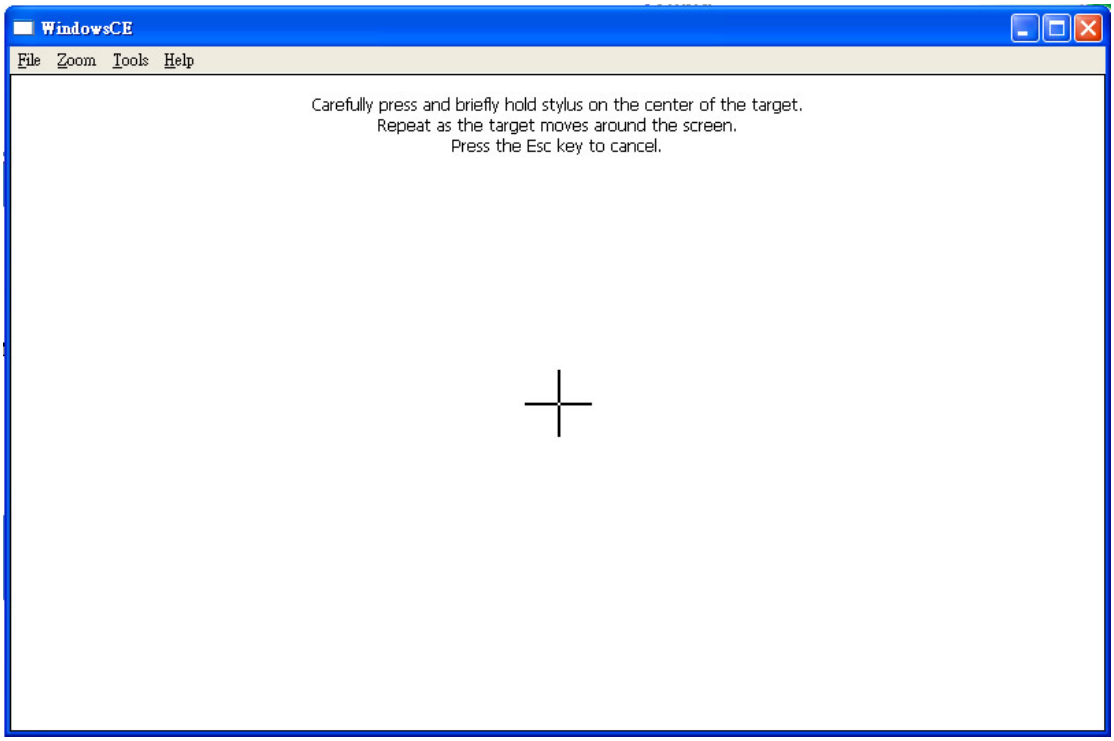
7.3.2. Touch Calibration

If your APC-6410 device is attached to a touch screen, you will need to calibrate your touch screen at first boot. The calibration value will be stored as HIVE. That means you don't need to calibrate again at next boot.

To calibrate your touch screen:

1. Go to **Start**->**Settings**->**Control Panel**->**Stylus**
2. Choose "**Calibration**" Tab and click on "**Recalibrate**". You will see below as shown in figure 7.3.3.

Figure 7.3.3 Calibrate touch panel


WindowsCE
File Zoom Tools Help
Carefully press and briefly hold stylus on the center of the target.
Repeat as the target moves around the screen.
Press the Esc key to cancel.

3. Carefully press and briefly hold stylus on the center of the cross target. Repeat as the cross target move around the screen.

7.3.3. File System and Registry Basic

7.3.3.1. Making Files Persistent

Files written or copied to **\NandFlash** are persistent from one boot to the next. Files written to **SD** memory cards (files in **\Storage Card**) or USB Compact Flash cards (files in **Hard Disk**) are also persistent. Files written anywhere else in the system at run time are volatile.

7.3.3.2. Re-formatting the NAND Flash Folder

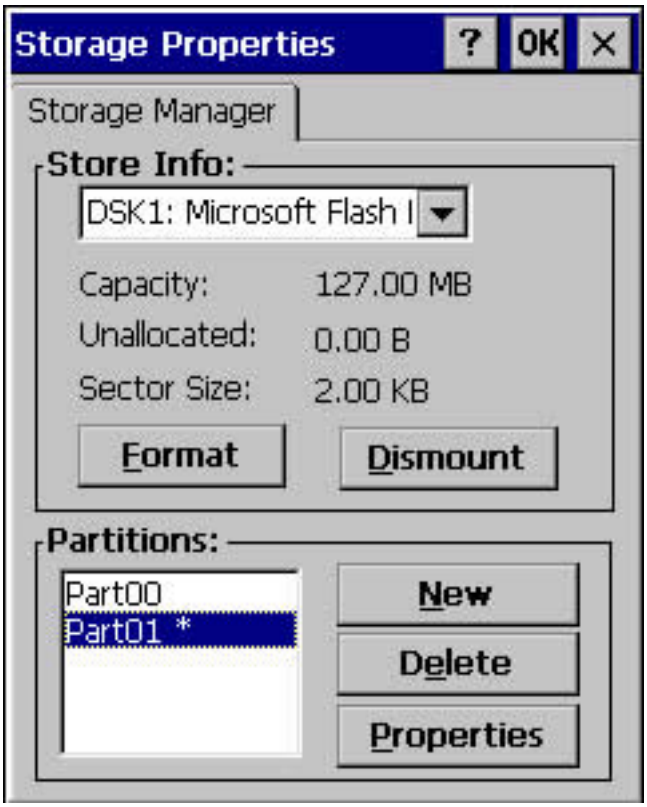
\NandFlash default has two partitions Part00 and Part01. Part00 is formatted as a BINFS filesystem by default and stores the system firmware including of NK.bin and boot HIVE information. Part01 is formatted as FAT filesystem by default and is reserved for user storage. NAND Flash would be automatically formatted and partitioned and mounted during the boot sequence. It would also create the "Documents and Settings" directory in the **\NandFlash** folder which is required for Hive-based Registry support (system.hv and user.hv) as explained later.

Manually, **\NandFlash** can be reformatted as follows. (Note that in case

the Part00 of the \NandFlash folder is manually formatted, users need to go to eboot menu to recover the NK at next boot.)

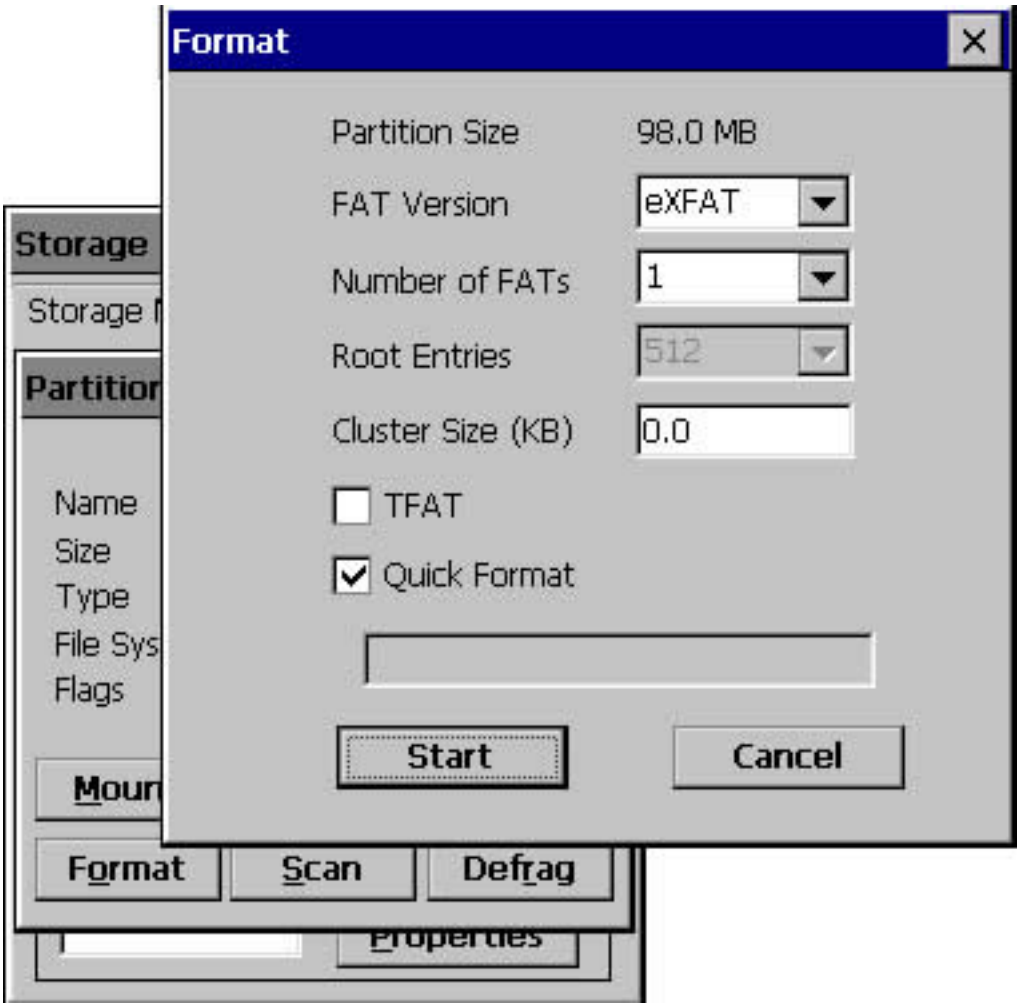
1. Go to **Start**->**Settings**->**Control Panel**->**Storage Manager**
2. Choose the one label with “DSK1: Microsoft Flash DISK” from **Store Info** and choose “Part01 *” (The asterisk sign represents that this partition has been mounted.) from **Partitions**.

Figure 7.3.4 Storage Manager Control Panel



3. Click **Properties.**
4. Click **Dismount**.
5. Click **Format**.

Figure 7.3.5 Format Part01 of NAND Flash



6. Click **Start**.
7. Click **Yes**.
8. Click **OK**.
9. Click **Mount**
10. Click **OK**
11. Exit out of Storage Properties by Clicking **OK**.

The user partition of NAND flash has been formatted now.

7.3.3.3. Persisting the Registry

WinCE Hive-Based Registry has been well implemented. The hive-based registry stores the registry data in files, or hives, which can be kept on any file system. This removes the need to backup and restore on power off. For detailed information, please refer to *Windows CE 6.0 Help* on relating topic. Embedian's CE 6.0 HIVE-based design will be automatically flushing the registry on changes. Users don't need

to flush registry manually.

All the hive-based registries are configured to be stored in **\NandFlash\Documents and Settings**. So if the **\NandFlash** folder is manually formatted, all the registry settings would be gone and it would be restored back to the default registry after the next reboot. Therefore, it is best to reboot the device if you have formatted the **\NandFlash** folder before proceeding with any operation.

To restore the default registry (it may interfere with software development), you have to go into the EBOOT, and press “4) Reset to factory default configuration” or just re-flash the NK again.

7.3.4. Networking Basics

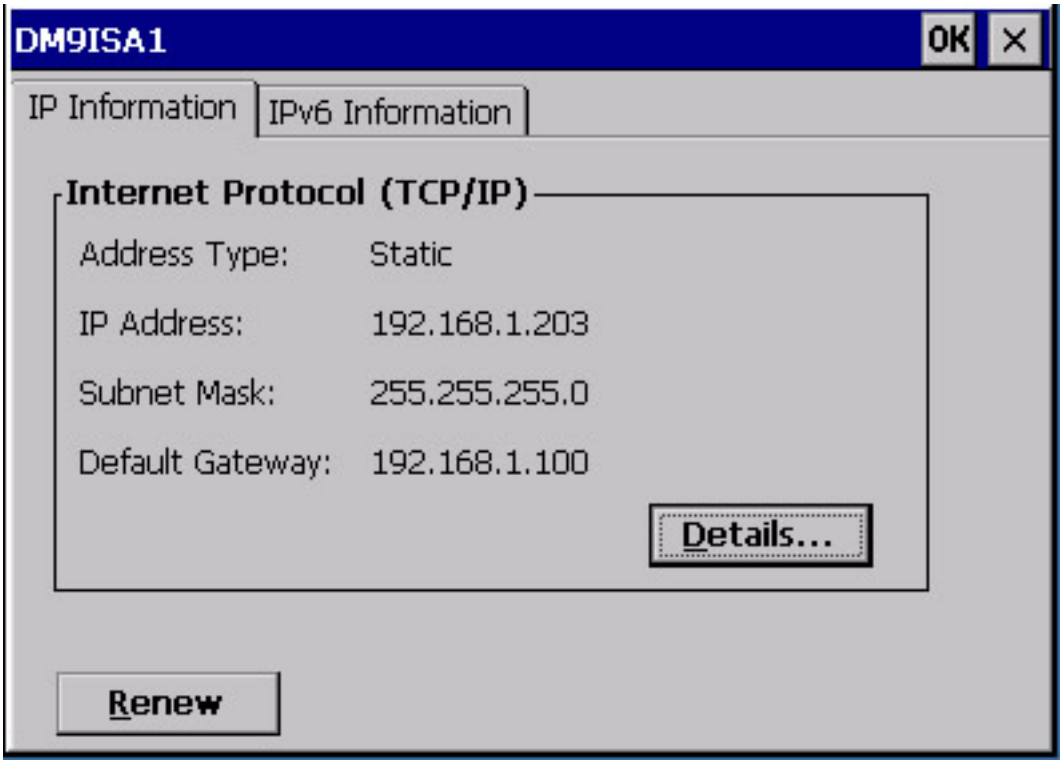
7.3.4.1. Getting the IP Address

To view your current IP address, simply double click on the network icon as shown in figure 7.3.6.

Figure 7.3.6 Network Icon

After double-clicking on this Icon a dialog box will be shown with available IP information as shown in figure 7.3.7.

Figure 7.3.7 IP Information Dialog



7.3.4.2. Setting Up IP Address or DHCP

If networking hardware such as a hub or switch is available, an Ethernet cable can be used to connect the APC-6410 to this hardware. Because of APC-6410 Ethernet function supports AUTO-MDIX Ethernet protocol, there is no need of crossover cable even it is direct link. Setting static addresses or DHCP on APC-6410 is described below. Once the addresses are properly set, the host PC will be able to communicate with the device.

On the APC-6410 desktop, tap

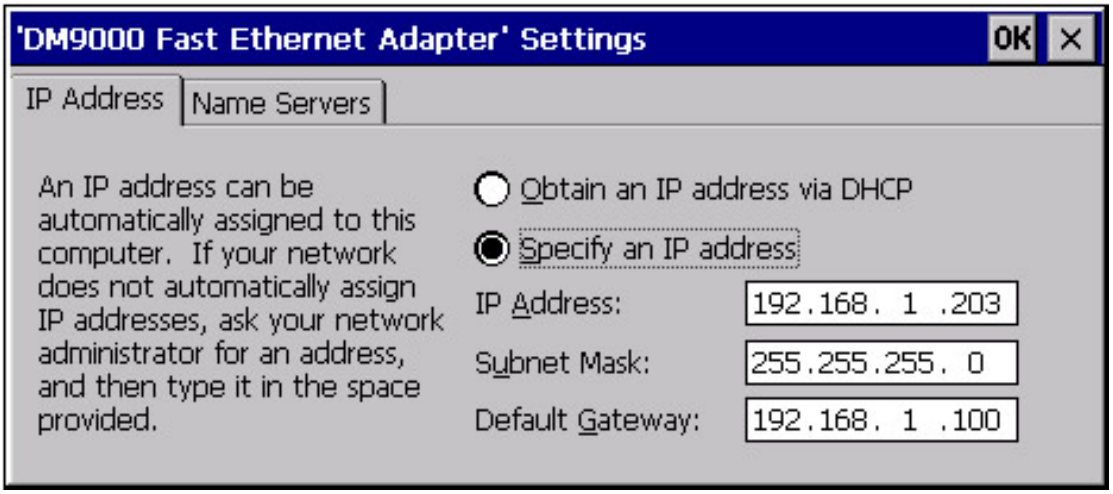
Start->Settings->Network and Dial-up Connections.

Double-tap the network connection icon (named after the DM9ISA1 driver used) to open the **Network Settings** dialog box.

Figure 7.3.8 Network Connection Icon

Change the appropriate settings and tap **OK.** Note that the settings will take effect immediately.

Figure 7.3.9 DHCP or Static IP Address Setting


'DM9000 Fast Ethernet Adapter' Settings
OK
IP Address
Name Servers
An IP address can be automatically assigned to this computer. If your network does not automatically assign IP addresses, ask your network administrator for an address, and then type it in the space provided.
Obtain an IP address via DHCP
Specify an IP address
IP Address:
192.168. 1 .203
Subnet Mask:
255.255.255. 0
Default Gateway:
192.168. 1 .100

Once the IP has been modified, it will be saved to HIVE registry and the IP and Ethernet configuration will be kept at next boot.

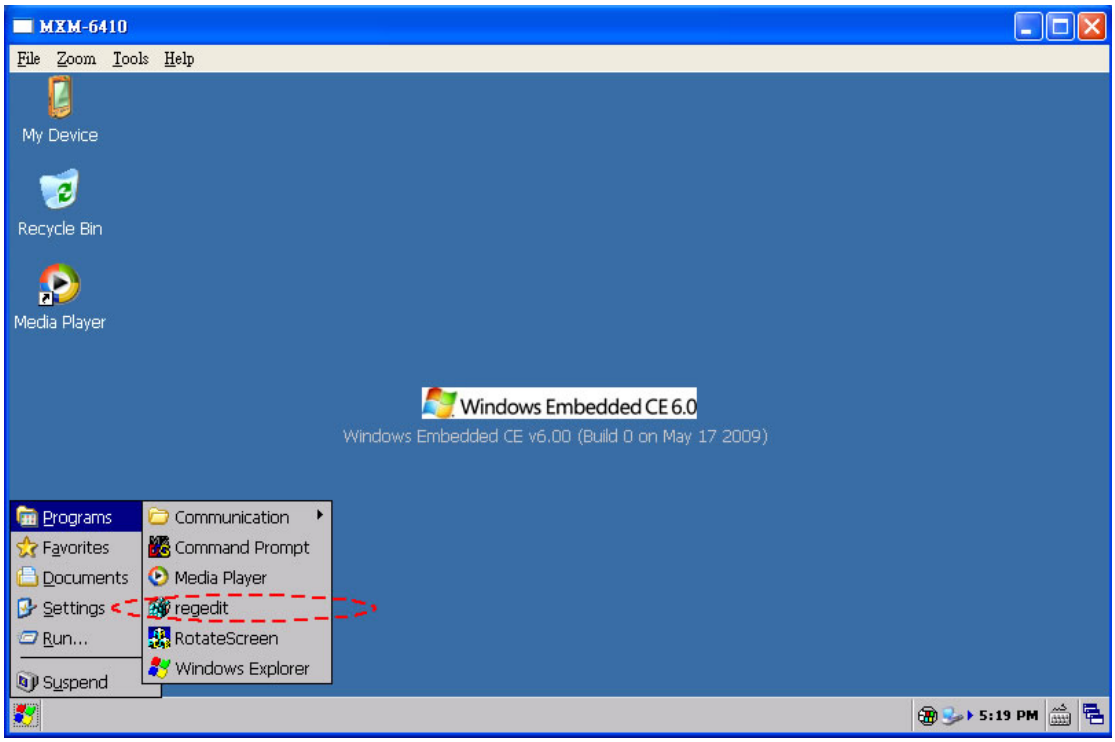
7.3.5. Telnet Server

The Telnet server in the factory-installed image is configured with no access restrictions. You could disable the Telnet server or restrict access to it before deploying the product or connecting to an unsecured network. The Telnet server is not started on APC-6410 hardware at boot by default.

To turn on the telnet service, users need to enable the "*IsEnabled*" registry key setting under the **HKEY_LOCAL_MACHINE\Comm\TELNETD** registry key. Figure 7.3.10 and figure 7.3.11 show how to enable the telnet service.

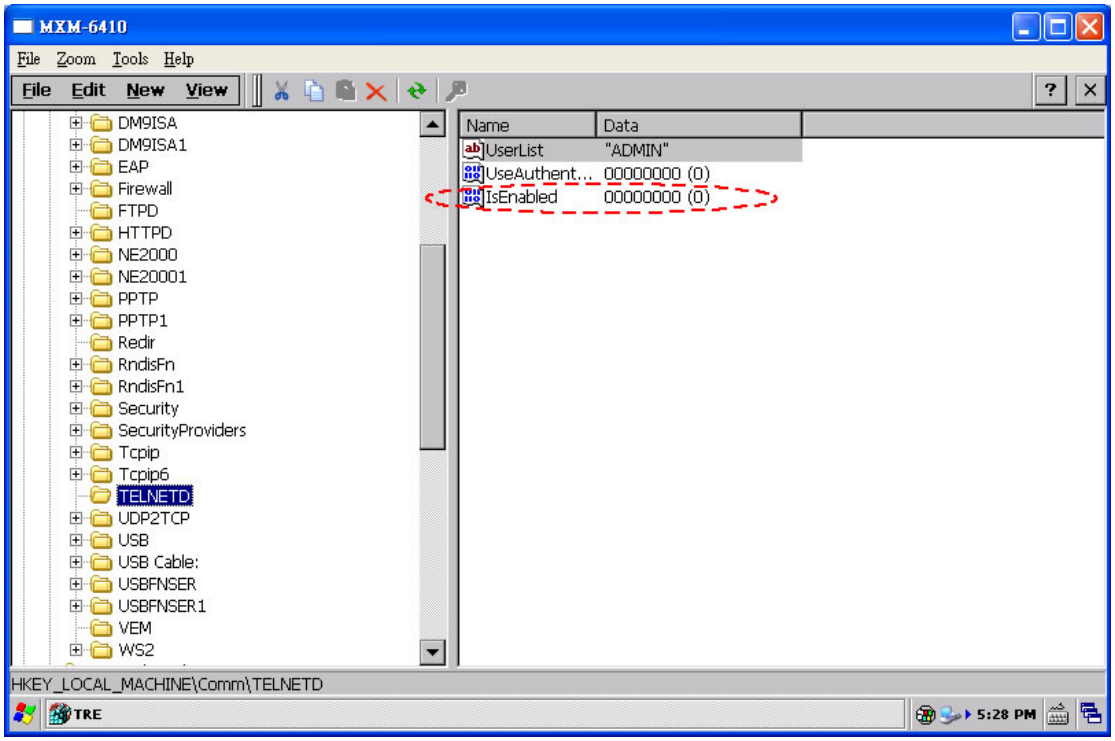
Go to **Start → Programs → regedit**

Figure 7.3.10 regedit Utility



The telnet registry settings are under the **HKEY_LOCAL_MACHINE\Comm\TELNETD** registry key. Double click the "*IsEnabled*" registry key set it from "0" to "***1***".

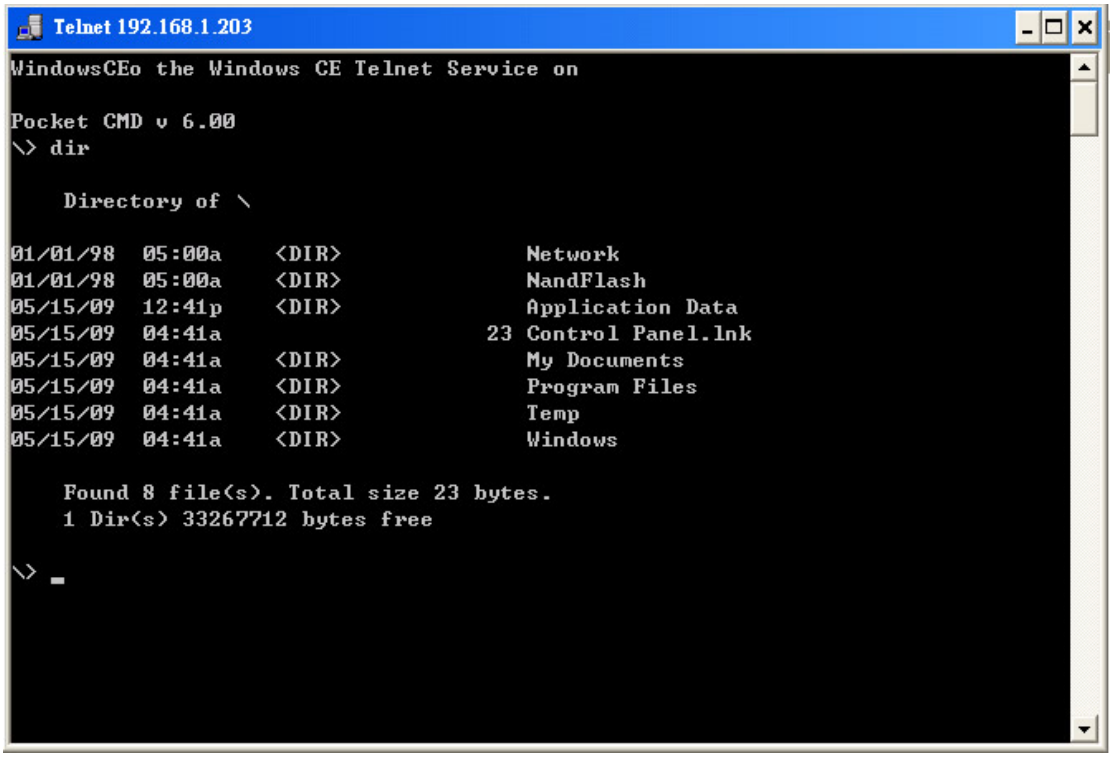
Figure 7.3.11 Enable Telnetd Service



Note: You will need to reboot the device to take effect the registry key enabled.

To access the Telnet server on an APC-6410 device, simply enter *telnet <Your Device IP Address>*. See the example below.

Figure 7.3.12 Telnet Prompt



Note: If you used telnet client like putty program to telnet in, the first few commands might give you a “command not found” message. Just a couple of trials will be fine. But Windows telnet command prompt will not appear to see this.

7.3.5.1. Default Registry Setting

It’s necessary to be aware of registry settings that impact security. The telnet registry settings are under the **HKEY_LOCAL_MACHINE\Comm\TELNETD** registry key.

Telnet server reads the values in the registry before serving each request. Therefore, changes made to the registry take effect immediately and do not require the telnet server to be restart. The registry change will be kept on next reboot.

Table 7.3.1. TELNETD Registry Value

HKEY_LOCAL_MACHINE\Comm\TELNETD	
Value	**Description**
IsEnabled : REG_DWORD	*Indicates if the Telnet server is enabled. Set this value to a non-zero value to enable the server, and to 0 to disable the server. If the sample Telnet server is started and this value has not been set, it defaults to accepting connections.*
UseAuthentication: REG_DWORD	*To require a password check on the user, set this value to 1; otherwise, set it to 0. By default, the Telnet sample requires authentication.*
UserList : String	*Provides a comma-separated list of allowed users. Requires UseAuthentication to be enabled.*

7.3.5.2. Changing the Telnet Server Access Privileges

To change the Telnet server access privileges, the Registry Editor tool under the **\Windows** folder (or **Start → Programs → regedit**) will be used.

To modify the Telnet server access privileges:

Step 1 Click the regedit.exe located at \Windows folder.

Step 2 Browse to the **HKEY_LOCAL_MACHINE\Comm\TELNETD**.

Step 3 Ensure that the **IsEnabled** value is **1**.

Step 4 Ensure that the **UseAuthentication** value is **0**.

Step 5 Set the **UserList** value to a semi-colon separated list of users. (For example, **user1;user2**).

Refer to the topic **Telnet Server User Lists** in the Platform Builder documentation for more detailed information on this subject.

Examples:

[HKEY_LOCAL_MACHINE\COMM\TELNETD]
UserList="GladysL;AnnD;-KimY;@SomeGroup;-@villains"

Allows GladysL, AnnD, and the SomeGroup group, but restricts the KimY user and the villains group.

The asterisk or the at sign and the asterisk (* or @*) allows all users,

and the combination of the hyphen and the asterisk, or the combination of the hyphen and the at sign and the asterisk (-* or -@*) denies all users.

The string is interpreted sequentially. In other words, if GladysL is member of the Finance group, the following strings will allow GladysL.

GladysL

@ Finance

@ Finance;GladysL

GladysL;@ Finance

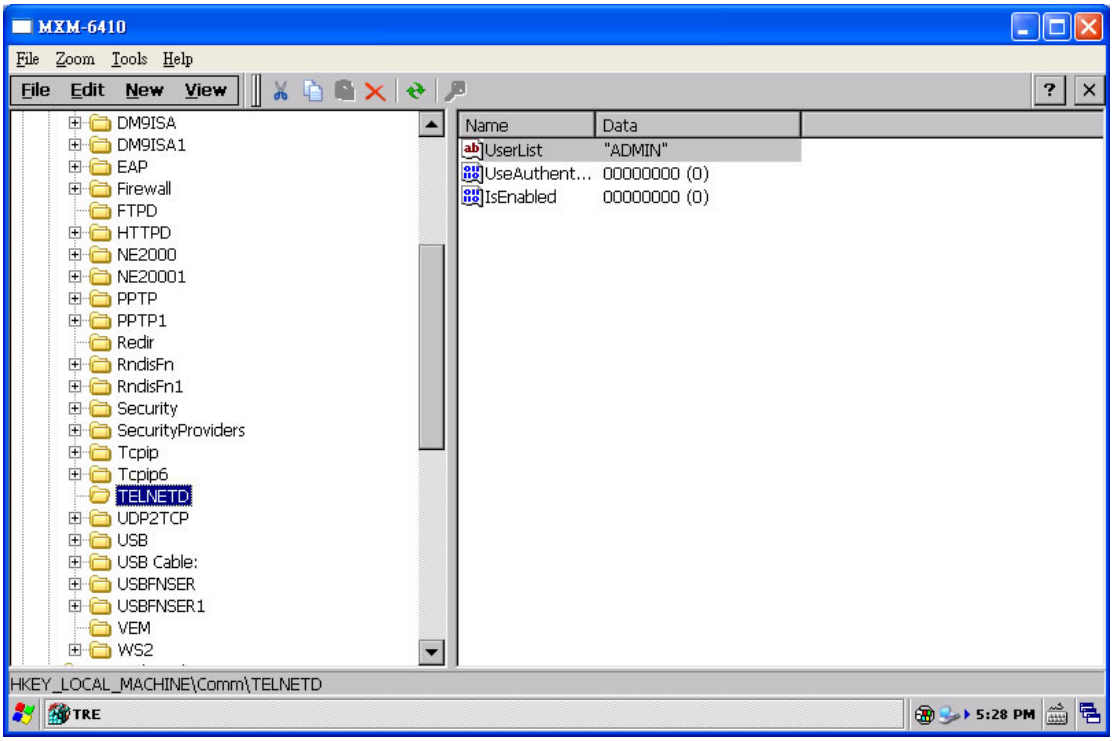
@ Admins;-GladysL

GladysL;-@ Finance

GladysL;-GladysL

*;-GladysL;-@ Finance

Figure 7.3.13 Telnet Registry



7.3.5.3. Security Note

The security on the Telnet server is very light and vulnerable to security attacks. Even if the Telnet server is configured to require password

authentication, the password is sent in plain text across the network and is therefore vulnerable to packet sniffing. A malicious user could obtain the password to APC-6410 by watching packets sent back and forth between the Telnet server and the client during the authentication stage. If a malicious user could log on to the device, they would have complete privileges over it. This could involve deleting or modifying key system files and the registry.

Because of the these serious security risks, it is strongly recommended you only run the Telnet server for development and debugging purposes, on a controlled, private network where you trust the users. It is strongly recommended that you do not deploy this Telnet server on a public network such as the Internet.

7.3.5.4. Recommendations

Set the user list and domain variables to prevent hacker attacks on your device. If Telnet server is used without appropriate values set for the User List and Domain variables, your Telnet server will be vulnerable to hacker attacks.

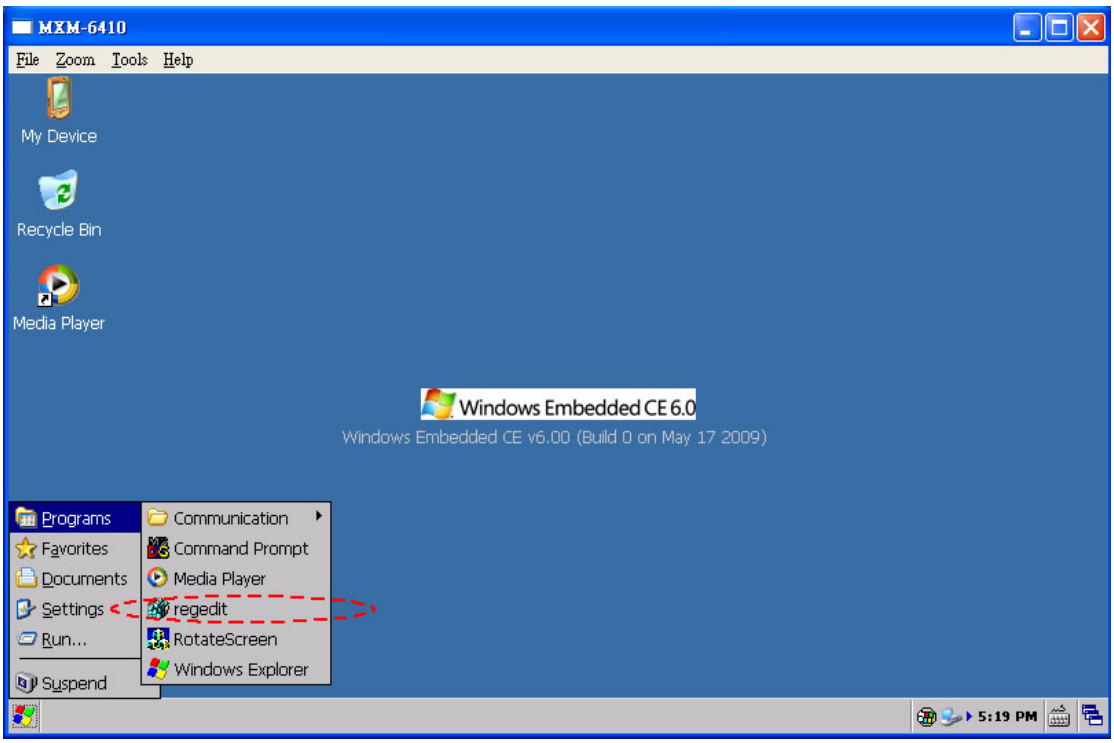
To prevent such attack, the user name is the **UserList** registry value must be set for each of the servers that are currently running. The use will then need to log in with the specified user name and appropriate password to use the server. You can also set the domain variable in the **DefaultDomain** registry value, which is located under **HKEY_LOCAL_MACHINE\Comm\Redir** registry key.

7.3.6. FTP Server

The FTP server in the factory-installed image is configured with no access restrictions. You should disable the FTP server or restrict access to it before deploying the APC-6410 or connecting to an unsecured network. The FTP server is not started on APC-6410 hardware at boot by default. To turn on the FTP service, users need to enable the "*IsEnabled*" registry key setting under the **HKEY_LOCAL_MACHINE\Comm\FTPD** registry key. Figure 7.3.14 and figure 7.3.15 show how to enable the ftp service.

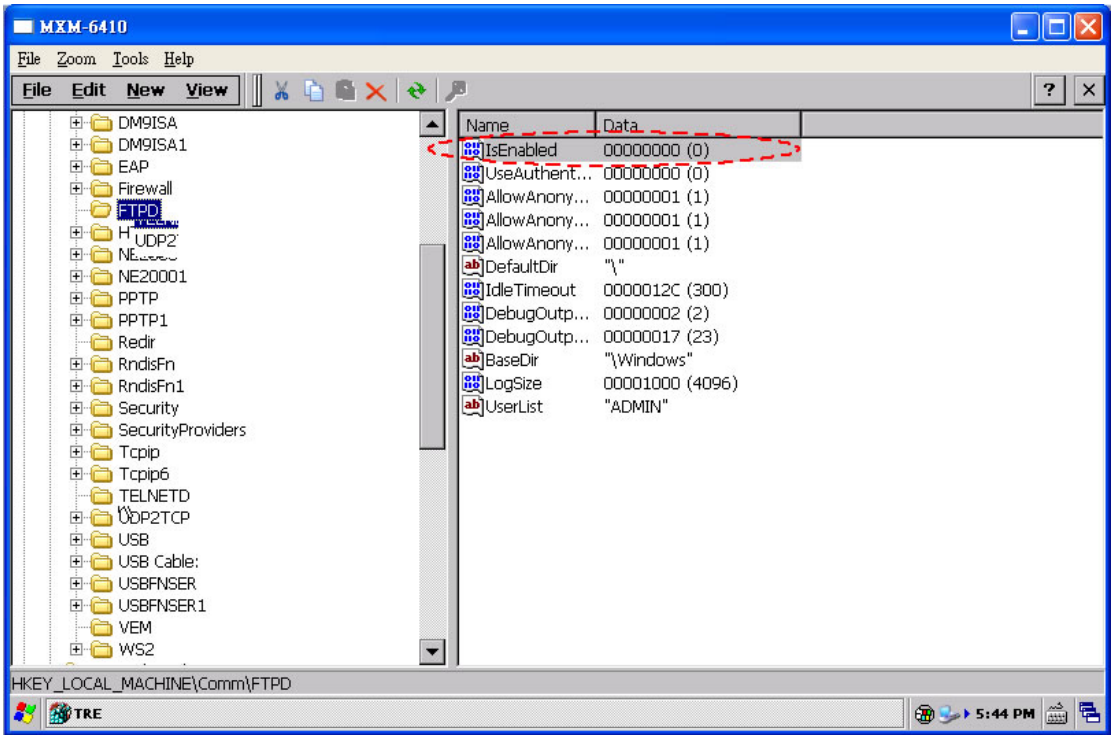
Go to **Start → Programs → regedit**

Figure 7.3.14 regedit Utility



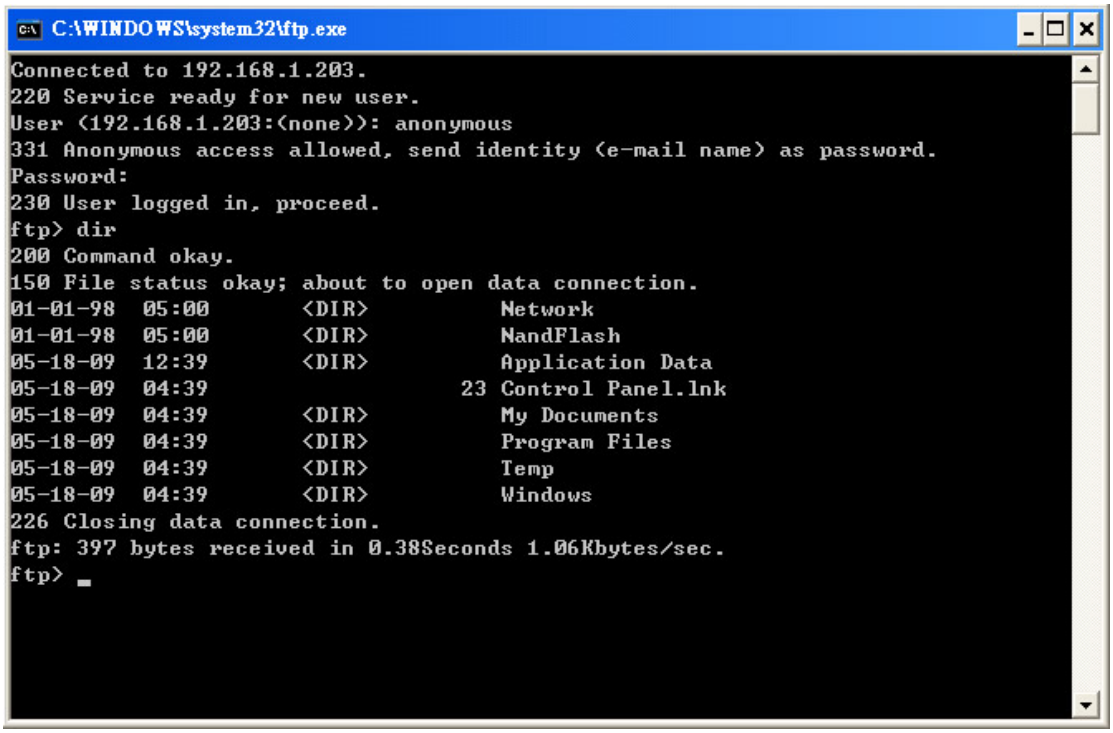
The ftpd registry settings are under the **HKEY_LOCAL_MACHINE\Comm\FTPD** registry key. Double click the "*IsEnabled*" registry key set it from "0" to "***1***".

Figure 7.3.15 Enable Ftpd Service



To access the FTP server on an APC-6410 device, simply enter *ftp <Your Device IP address>* at your PC command prompt. See the example below.

Figure 7.3.16 FTP Prompt

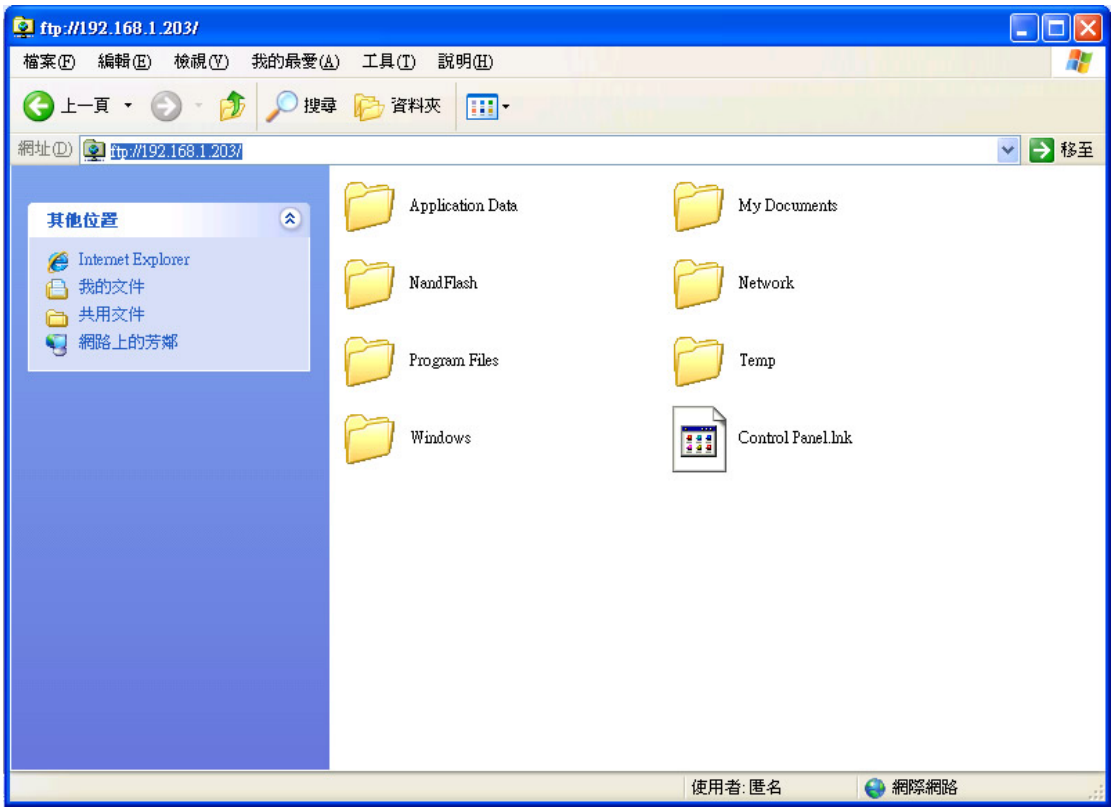

C:\WINDOWS\system32\ftp.exe
Connected to 192.168.1.203.
220 Service ready for new user.
User (192.168.1.203:(none)): anonymous
331 Anonymous access allowed, send identity (e-mail name) as password.
Password:
230 User logged in, proceed.
ftp> dir
200 Command okay.
150 File status okay; about to open data connection.
01-01-98 05:00 <DIR> Network
01-01-98 05:00 <DIR> NandFlash
05-18-09 12:39 <DIR> Application Data
05-18-09 04:39 23 Control Panel.lnk
05-18-09 04:39 <DIR> My Documents
05-18-09 04:39 <DIR> Program Files
05-18-09 04:39 <DIR> Temp
05-18-09 04:39 <DIR> Windows
226 Closing data connection.
ftp: 397 bytes received in 0.38Seconds 1.06Kbytes/sec.
ftp>

Once this *ftp <Your Device IP address>* command has been entered, the FTP server will respond by asking for a username and password. It is currently configured to allow any user in with any password, including **anonymous**.

Use File Browser to access the FTP Server

A regular file browser in your Windows PC may be used to access the FTP server as well. To use the FTP server this way, use *ftp://the device IP address*.

Figure 7.3.17 Use File Browser to access FTP Server



APC-6410 implementation of FTP server enables you to transfer files from a desktop computer using a TCP/IP connection. The implementation of FTP server in APC-6410 is based on RFC 959. This included FTP server supports the minimum implementation of the FTP protocol defined in RFC 959. This minimum implementation includes configuration values, transfer parameters, and ASCII and Image data types, and allows FTP to operate with a minimum of error messages.

7.3.6.1. Default Registry Setting

It's necessary to be aware of registry settings that impact security. The telnet registry settings are under the **HKEY_LOCAL_MACHINE\Comm\FTPD** registry key.

FTP server reads the values in the registry before serving each request. Therefore, changes made to the registry take affect immediately and do not require the ftp server to be restart. The registry change will be kept on next reboot.

Table 7.3.2. FTPD Registry Value

HKEY_LOCAL_MACHINE\Comm\FTPD	
Value	**Description**
AllowAnonymous : REG_DWORD	*Default set to 1. Possible values are 0 (false) or 1 (true).* *Determines whether the server will allow anonymous access.*
AllowAnonymousUpload : REG_DWORD	*Default set to zero (0). Possible values are 0 (false) or 1 (true).* *Determines whether authorization is required to upload files to the server, delete files from the server, and rename files.*
AllowAnonymousVroots : REG_DWORD	*Default set to zero (0). Possible values are 0 (false) or 1 (true).* *Specifies whether access to virtual roots is granted or denied to anonymous users.*
DefaultDir : String	*Default root directory. Directory and subdirectories of this key are accessible remotely. If this value is not set in the registry, the default is \Temp.*
IsEnabled : REG_DWORD	*Default set to 1. Possible values are 0 (false) or 1 (true).* *Determines whether or not the server will accept incoming connections. This value is typically used to keep the server disabled at boot time.*
UserList : REG_MULTI_SZ	*Provides a comma-separated list of allowed users.*
NoSystemInfo : REG_DWORD	*No default set in registry.* *Uses value of 0 if no value is set. If NoSystemInfo is set to 1, and a remote FTP*

	client requests the Operating System name and version from the FTP server (via the "SYST" command), the FTP server will not indicate it.

7.3.6.2. Changing the FTP Server Access Privileges

To change the FTP server access privileges, the Registry Editor tool under the **\Windows** folder (or **Start → Programs → regedit**) will be used.

To modify the FTP server access privileges:

Step 1 Click the regedit.exe located at **\Windows** folder.

Step 2 Browse to the **HKEY_LOCAL_MACHINE\Comm\FTPD**.

Step 3 Ensure that the *IsEnabled* value is **1**.

Step 4 Ensure that the *UseAuthentication* value is **0**.

Step 5 Set the **UserList** value to a semi-colon separated list of users. (For example, **user1;user2**).

Refer to the topic **Telnet Server User Lists** in the Platform Builder documentation for more detailed information on this subject.

Examples:

[HKEY_LOCAL_MACHINE\COMM\TELNETD]
UserList="GladysL;AnnD;-KimY;@SomeGroup;-@villains"

Allows GladysL, AnnD, and the SomeGroup group, but restricts the KimY user and the villains group.

The asterisk or the at sign and the asterisk (* or @*) allows all users, and the combination of the hyphen and the asterisk, or the combination of the hyphen and the at sign and the asterisk (-* or -@*) denies all users.

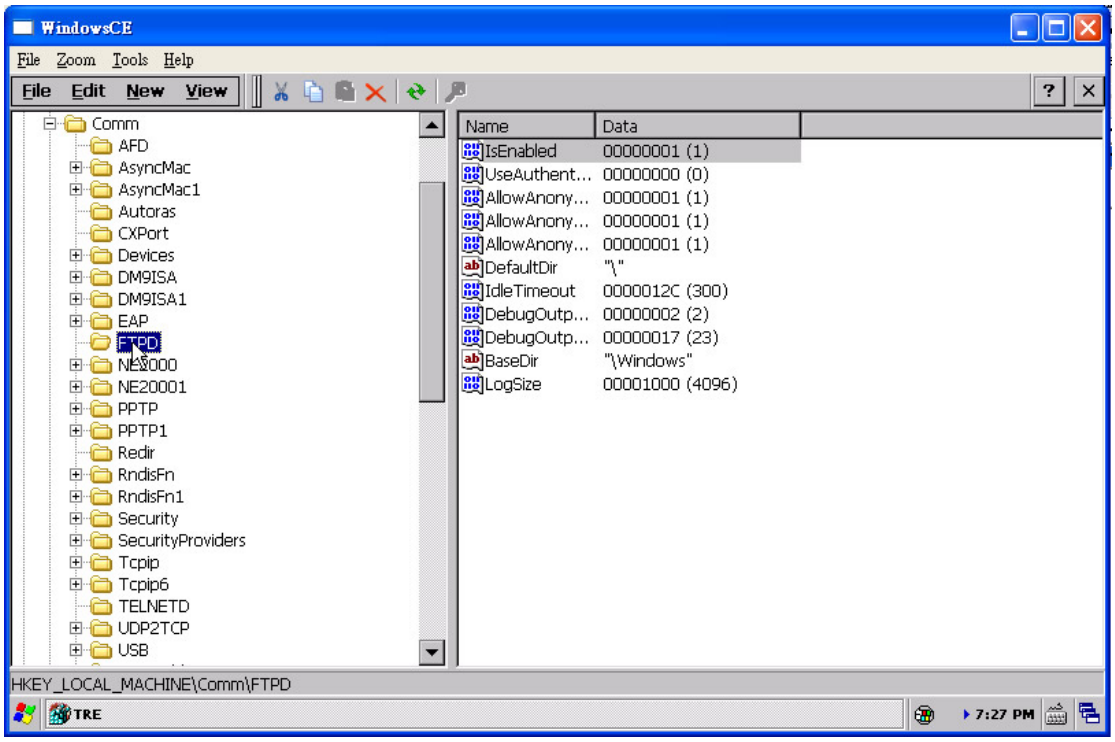
The string is interpreted sequentially. In other words, if GladysL is member of the Finance group, the following strings will allow GladysL.

GladysL
@ Finance
@ Finance;GladysL
GladysL;@ Finance
@ Admins;-GladysL

GladysL;-@ Finance
GladysL;-GladysL
*;-GladysL;-@ Finance

Step 6 Set the **AllowAnonymous** value to 1 if you wish to enable anonymous FTP logins.
Step 7 Set the **AllowAnonymousUpload** value to **1** if you wish to enable anonymous users from uploading files to the FTP server.
Step 8 Set the **DefaultDir** string to whichever directory you wish to use as the FTP root directory. Users will not be able to go outside of this directory.
Further information may be found in the Platform Builder documentation on the FTP server, located in **Application Development > FTP Server**.

Figure 7.3.18 FTP Registry



7.3.6.3. Security Notes

If **AllowAnonymous** is set to true, it will allow users to connect the server without providing verifiable credentials. Anyone can log in using the username “anonymous” and any password to gain access. It is

recommended that you set this value to false and use the **UserList** registry setting to specify all allowed users.

If **AllowAnonymousUpload** is set to true, unauthenticated users will be able to copy files to, and delete files from, your server. This can be very dangerous because attackers might upload dangerous applications and documents, or they might delete important system files. It is not recommended to allow upload permission for anonymous users.

If **AllowAnonymousVroots** is set to false, anonymous users will only be able to access the main FTP shares. If this value is set to true, unauthenticated users will also be able to access VROOTs as well as the main share. Therefore you should use this setting with caution.

Setting **UseAuthentication** to false enables clients to connect to the server without providing credentials. It is therefore strongly recommended that you do not set this value to false. Change this setting only if you have anonymous clients that must access the server but cannot or will not send USER and PASS credentials.

It is recommended that you set this value to a list of users who should have access to the server and its member VROOTs. Specifying the allowed users in **UserList** and setting **AllowAnonymous** to false will help protect the device from most attacks and keep your files available only to those users who need to see them.

7.3.6.4. Recommendations

Set the user list and domain variables to prevent hacker attacks on your device. If FTP server functionality is used without appropriate values set for the User List and Domain variables, the FTP server will be vulnerable to hacker attacks.

These variables are not set by default. A hacker must only guess the device's password, the way it is set in Control Panel, to obtain access to server.

To prevent such attack, the user name is the **UserList** registry value must be set for each of the servers that are currently running. The use will then need to log in with the specified user name and appropriate password to use the server. You can also set the domain variable in the **DefaultDomain** registry value, which is located under

HKEY_LOCAL_MACHINE\Comm\Redir registry key. Setting the **DefaultDomain** registry value will require FTP clients to have valid domain credentials to log in.

7.3.7. File Server

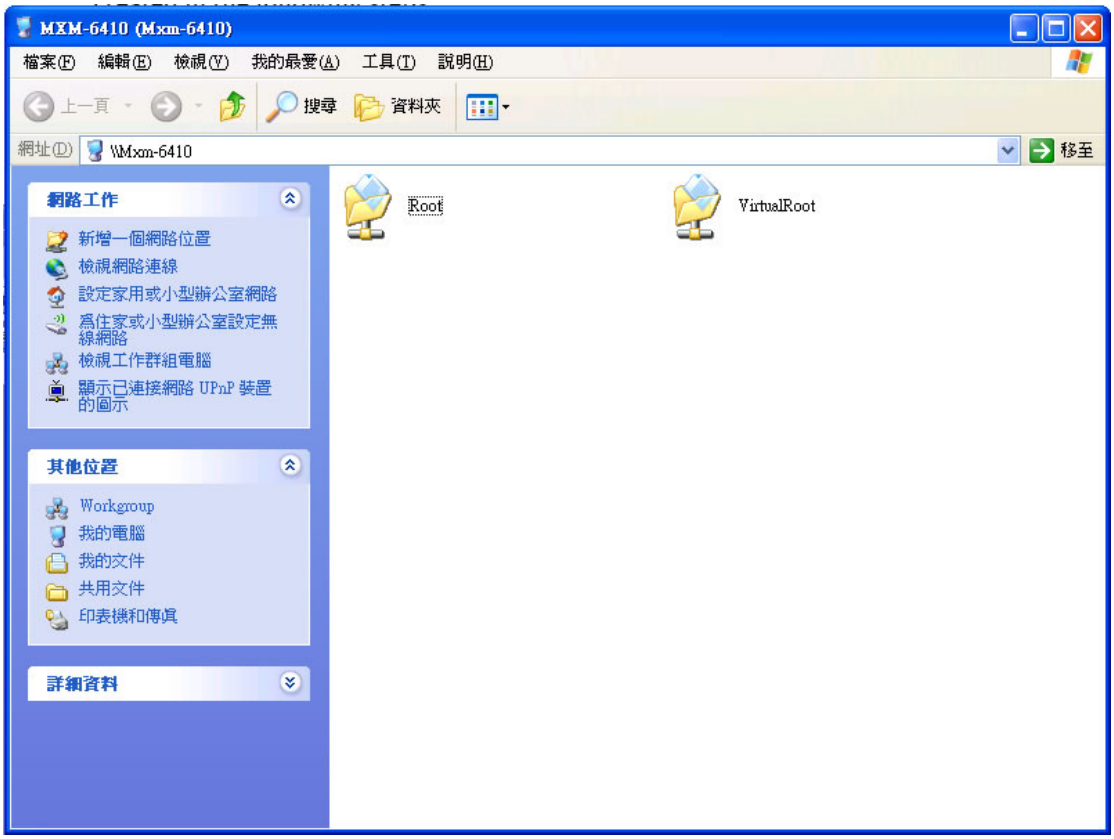
File server in the factory-installed image is configured with no access restrictions. You should disable the file server or restrict access to it before deploying the APC-6410 or connecting to an unsecured network. The File Server enables clients to access files and other resources, such as printer, from a server over using TCP/IP. File Server uses the Common Internet File System (CIFS). This is an extension to the Server Message Block (SMB) file sharing protocol. CIFS enables a network-enabled application to access and manipulate files and directories on a remote server in the same way that the application accesses and manipulates files and directories on the local system.

To use the file server, users can access and browse the shared folders that created in the default registry in the following steps.

1. On the PC, from the **Start** menu, choose **Run**.
2. In the Open box, type **\\MXM-6410**, and then choose **OK**.

You can now browse the shared files in devices as showed in figure 7.3.19.

Figure 7.3.19 Access File Server

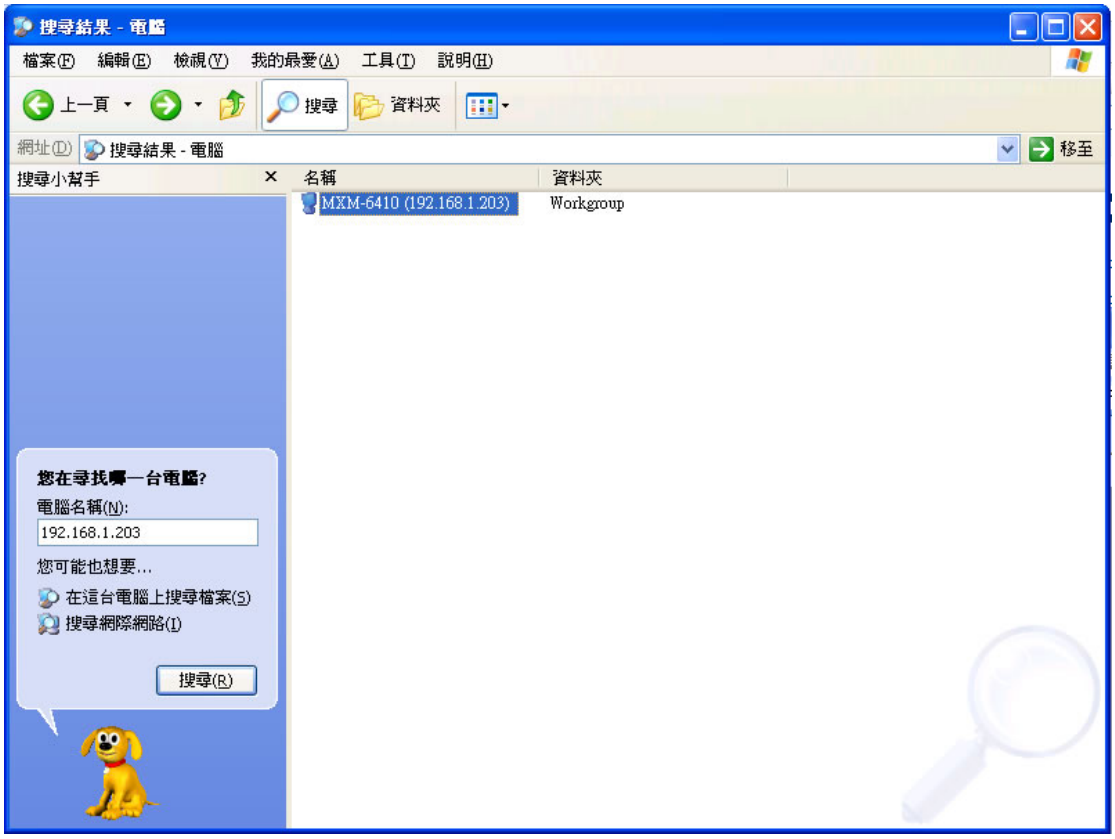


The alternative way to access to shared files in the file server is described as follows.

1. On the PC, from the **Start** menu, choose **Search**.
2. In the searching menu, choose **Computer or People**, and then choose **Computer on the network**.
3. In the Open box, type **MXM-6410 or <Device IP Address>**, and then click **Search**.

You can now browse the shared files in devices as showed in figure 7.3.20

Figure 7.3.20 The other way to access file server from PC



7.3.7.1. Default Registry Settings

The registry stores information necessary to configure the system for applications and hardware devices. The registry also contains information that the operating system continually references during operation. APC-6410 enables you to create virtual file server directories. To users who access your file server share, virtual directories appear as subdirectories of the file server share, although these directories may be located in a different folder. You can create a virtual root directory called “VirtualRoot” that points to \Windows directory of the device and a root directory called “Root” that points to \NandFlash directory of the device by specifying the following registry key:

HKEY_LOCAL_MACHINE\Services\SMBServer\Shares\Root and

HKEY_LOCAL_MACHINE\Services\SMBServer\Shares\VirtualRoot

Note the maximum length of the virtual root directory and root directory

is 12 characters.

Table 7.3.3. File Server Registry Value

HKEY_LOCAL_MACHINE\Services\SMBServer\Shares	
Value	**Description**
UseAuthentication: REG_DWORD	*No default set. Setting this value to 0 will disable the authentication on the file server. The file server will be accessible to all users on the network.*

Table 7.3.4. VirtualRoot/Root of File Server Registry Value

HKEY_LOCAL_MACHINE\Services\SMBServer\Shares\VirtualRoot **HKEY_LOCAL_MACHINE\Services\SMBServer\Shares\Root**	
Value	**Description**
Path : String	*Specifies the path to be shared.*
Type: REG_DWORD	*Setting this value to 1 designates this as a print server share, setting this value to 0 (zero) designates this as a file server share.*
UserList : String	*Provides a comma-separated list of allowed users. Requires UseAuthentication to be enabled.*

7.3.7.2. Security Note

The default setting of authentication on the file server is disabled. However, it is not recommended that you disable authentication on the file server and you share the \Windows or root directory.

You can specify a list of folders that cannot be shared. You can use any name for each folder you specify in the exclusion list. Setting the **HKEY_LOCAL_MACHINE\Services\SMBServer\Shares\ExcludePaths**

registry key prevents the configuration functions from creating the specified shares, so that they cannot be accessed by an un-trusted application.

Table 7.3.5 An example to exclude the folders to be shared

HKEY_LOCAL_MACHINE\Services\SMBServer\Shares\ExcludePaths	
Value Name	**Value**
“Windows”	*“\\Windows”*
“My Documents”	*“Documents and Settings”*

7.3.8. Web Server

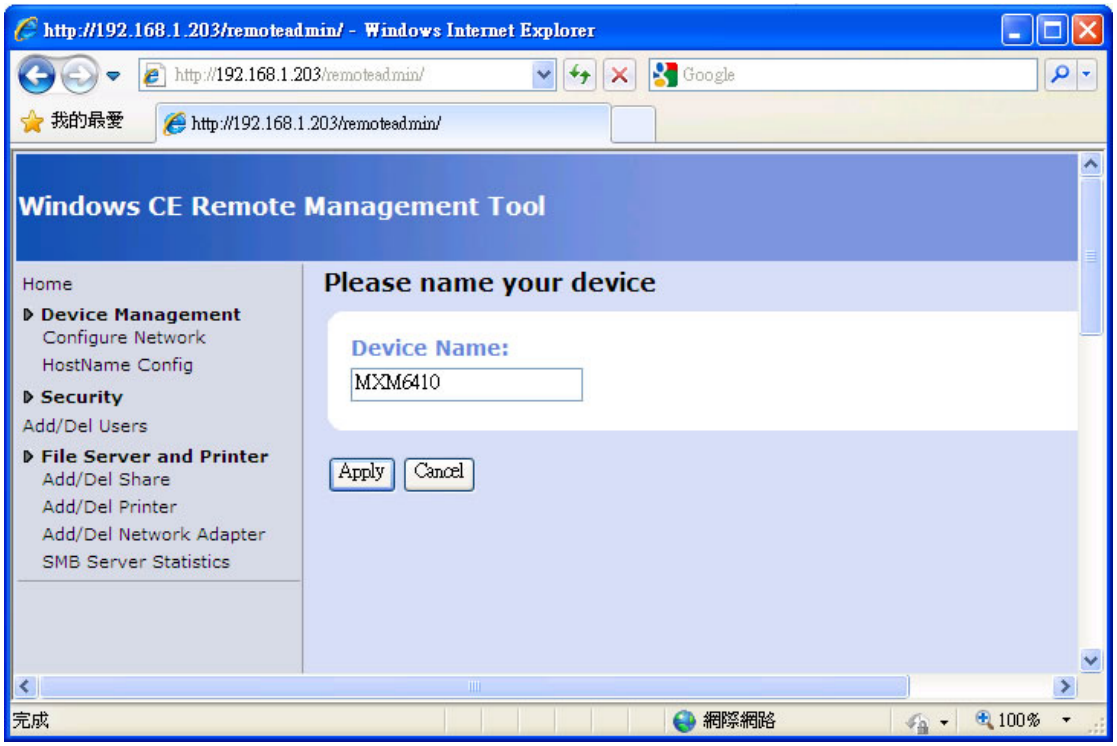
Web server facilitates the use of the Internet for communication between APC-6410 device and network printers, scanners, and other shared equipment. The Web server applications send Hypertext Markup Language (HTML) pages to a requesting browser. Users only need to have an Internet connection and a browser to be able to make use of the Web server functionality. The Web server supports IPv6 and also supports the use of Active Server Pages (ASP).

The HTTP server is not started on APC-6410 hardware at boot by default. To turn on the telnet service, users need to enable the “*IsEnabled*” registry key setting under the

HKEY_LOCAL_MACHINE\Comm\HTTPD registry key.

To access the Web server, just type <*IP Address*> at the Web browser. The default Web service configuration setting is remote administration page. It is very useful to use when the device is without display. At first connection to the Web server, users will be asked to input the password and re-type to confirm. After that, figure 7.3.21 shows the remote administration pages.

Figure 7.3.21 Remote Administration Page



Note: If users would like to use a own custom webpage, users need to modify the "*Default*" registry key setting under the **HKEY_LOCAL_MACHINE\Comm\HTTPD\VROOTS\/** registry key from "*$REDIRECT*" to "*\windows\www\wwwpub*"

7.3.8.1. Default Registry Settings

It is necessary to be aware of the registry settings that impact security. The Web server settings are located under the **HKEY_LOCAL_MACHINE\Comm\HTTPD** registry key. If you make changes to the Web server registry settings, it is necessary to stop the Web server and restart it to make the changes take effect. The "*IsEnabled*" registry value is default set to disable the Web service and is checked only when the Web server is initially loaded. If the registry value is set to zero (0), the Web server does not start. Changing this value to zero (0) while the Web server is running has no effect. You also must stop the Web server to make it stop accepting connections.

Table 7. 3.6. HTTPD Registry Key and Named Values

HKEY_LOCAL_MACHINE\Comm\HTTPD	
Value	**Description**
BasicRealm : **String**	*Specifies the string that the Web Server will send to clients as its Basic realm when performing basic authentication. If this registry value is not set, the Web Server will default to using the string "Microsoft-WinCE".*
IsEnabled : **REG_DWORD**	*If the value is not set in the registry, the Web Server is enabled. If the value is set to zero (0), the Web Server does not accept connections from the network, even from the local host.*
Port : **REG_DWORD**	*Default setting is 80. This port receives HTTP connections. Do not set the port to zero (0). When the Web Server is running from Services.exe, which is the default, this value is ignored and Services.exe becomes the super server.*
Basic : **REG_DWORD**	*Default setting is zero (0). If this value is nonzero, the Web Server uses Basic authentication for client connections.* *Enables Basic authentication, which enables the client browser to send the user identifier and password to the server.*
NTLM : **REG_DWORD**	*Default setting is 1. If this value is set to nonzero, the Web Server uses NTLM authentication for client browser connections. Also, if this value is nonzero, the failure of Basic authentication forces NTLM authentication.* *If the value is not set in the registry, NTLM is not used.*
DirBrowse : **REG_DWORD**	*Default setting is zero (0). If this value is set to nonzero, directory browsing is allowed. If this value is not set in the registry, directory browsing is turned off.* *Turns on the Web Server's ability to provide local*

	directory browsing.
Filter DLLs : **String**	*Default not set in the registry.* *Specifies a list of DLL names, separated by commas, that identifies the filters to use.*
DefaultPage : **String**	*Default not set in the registry. If the value is not present in the registry, the Web Server will use "default.htm;index.htm".* *Specifies a list of page names, separated by semicolons, that indicates names interpreted by the Web Server to be default pages. When browsing a directory, the Web Server traverses this list searching for a file of the same name in the directory. If the file exists, it is sent to the client. If no matching file exists, the Web Server sends a directory listing or returns an error, depending on whether directory browsing is enabled. If more than one DefaultPage file name is matched, the Web Server uses the first matching file name.*
AdminUsers : **String**	*Default not set in the registry.* *Specifies a list of user names, separated by semicolons. A user who has gained user access must be listed in this key to gain Administrator access.*
LogFileDirectory : **String**	*Default setting is "\windows\www" directory. If the name is not set or if the specified directory is inaccessible, no logging is performed.* *Specifies the name of the directory where the logging files are created.*
PostReadSize : **REG_DWORD**	*If the value is not set in the registry, PostReadSize will default to 48 KB. The Web Server uses a minimum value of 8192 bytes (8 KB). If the value in the registry is less than 8 KB, the value is ignored and the Web Server will use 8 KB.*

	Specifies the maximum number of bytes that the Web Server reads when receiving POST data. To read more data, you must use a raw data filter or call ReadClient in an ISAPI extension.
MaxLogSize : REG_DWORD	*Default setting is 32 KB. If this value is not set in the registry, or if it is set to zero (0), no logging is performed.* *Specifies the maximum size, in bytes, that a log file can become before it is rolled over.*
MaxHeaderSize : REG_DWORD	*Default setting is 48 KB in the registry.* *Specifies the maximum number of bytes that the Web Server will read of HTTP headers. If the header size exceeds this value, the Web Server will terminate the session and return a message to the client: 400 - Bad Request.*
MaxConnections : REG_DWORD	*Default is not set in the registry. If the value is not set in the registry, MaxConnections will default to 10.* *Specifies the maximum number of simultaneous connections to the Web site. After the maximum number of connections is established, additional client requests will be sent a message: 503 – Server Too Busy.*
ServerID : String	*Default is not set in the registry. If the value is not set in the registry, ServerID will default to "Microsoft-WinCE/X.Y", where X is the major version and Y is the minor version of Windows CE-based device.* *If ServerID is set, the Web Server returns the specified server name in the response header.* *Identifies the server name that is included when the Web Server generates HTTP response headers. The response header includes a field name "Server: ".*

	Optionally, you can include the software version number or any similar information in the string.

7.3.8.2. Security Note

When using ***Basic*** authentication, the client browser sends the user identifier and password to the server in clear text. In addition, all data sent between the client and browser is in clear text and therefore vulnerable to packet sniffing. You should consider using SSL to help protect sensitive information.

NTLM Although the client browser sends the password to the server in encrypted format, all data sent between the client and the browser is in clear text and therefore vulnerable to packet sniffing. You should using SSL to help protect sensitive information.

DirBrowse turns on Web server's ability to provide local directory browsing. This exposes the local file system to remote browser through HTTP. Users can view file lists and download files depending on virtual root and authentication registry settings. Enabling directory browsing increases the potential attack surfaces, therefore you should enable directory browsing only when necessary.

AdminUsers User names in this list identify the administrators of the site who have access to all virtual roots hosted on this Web site, including the restricted sites. Choose these users carefully and ensure that they set proper password, otherwise their accounts could be used to gain access to restricted sites.

MaxConnections Setting the value too small can block user access to the site. However, if the value is too large, the Web server will consume more system resources. Based on your deployment model, choose this number appropriately.

ServerID To avoid revealing the server software information to malicious users, you may want to create a custom server name that obfuscates the Web Server and operating system versions.

7.3.8.3. Recommendations

A typical deployment uses a Web server in a private network to provide a remote user interface to configure a headless device. The registry defines the number of connections and when the ***MaxConnections*** registry value is not set, the registry limits the number to 10.

A typical deployment uses the Web server to display status information or to host a family or community Web site. You should not use the Web server to perform critical operations, such as machine control or financial processing.

Use NTLM and/or Basic authentication mechanism to limit access to known users only. You can set the option in the **HKEY_LOCAL_MACHINE\COMM|HTTPD** registry key.

SSL protocol helps to protect data from packet sniffing by anyone with physical access to the network.

Carefully choose your virtual roots and limit access to the appropriate files by providing appropriate user access lists. Anonymous users with access to the virtual root may be able to access files and directories within that virtual root.

You can set the options in **HKEY_LOCAL_MACHINE\COMM|HTTPD\VROOTS** registry key.

7.3.9. Auto RUN

When Windows CE begins loading, the kernel starts the file system and examines the **HKEY_LOCAL_MACHINE\Init** registry key to identify what applications to run. To control which applications run at system startup, create launch registry values. Launch registry values do not need to be stored in the registry, although you can specify dependencies. You can specify up to 32 applications.

Table 7.3.7. Named values of HKEY_LOCAL_MACHINE\Init Key

HKEY_LOCAL_MACHINE\Init	
Value	**Description**
Launch*nn* : String	*Specifies the application to launch in order "nn"*
Depend*nn* : Binary	*Launchnn registry values have optional dependencies as denoted by the Dependnn registry value.*

Depend*nn* registry values specify applications that Windows CE must be running before the **Launch*nn*** applications run.

Depend*nn* registry values begin with the keyword **Depend**, followed by the same decimal number as the **Launch*nn*** registry value.

The **Depend*nn*** registry values define an order in which Windows CE launches applications. One or more dependent applications can be specified per **Depend*nn*** value. Dependent applications are specified as a series of Words in hexadecimal notation.

Table 7.3.8. Typical Init Registry Entry Using Dependencies

HKEY_LOCAL_MACHINE\Init	
Value Name	**Value**
Launch20	*device.dll*
Launch30	*gwes.dll*
Depend30	*2 length binary value*
Launch50	*explore.exe*

Depend50	*4 length binary value*
Launch60	*serviceStart.exe*
Depend60	*2 length binary value*

If your applications have dependencies with other applications, use the registry editor to setup your applications manually. After finishing the registry setup, the system will automatically flush the registry on changes to HIVE.

7.3.10. COM Ports

7.3.10.1. Introduction

The APC-6410 names the serial ports as “COMx”. Note the **COM_IOCTL_SET_OPERATION_MODE** call will be returned with error if trying to configure a non-configurable port.

Table 7.3.9. Related Win32 APIs to Configure COMx

Device Name: COMx:	
Win32 Functions	**Description**
CreateFile	*Opens COMx devices.*
CloseHandle	*Closes COMx device.*
DeviceIoControl	*Calls a customized IOCTL function.*

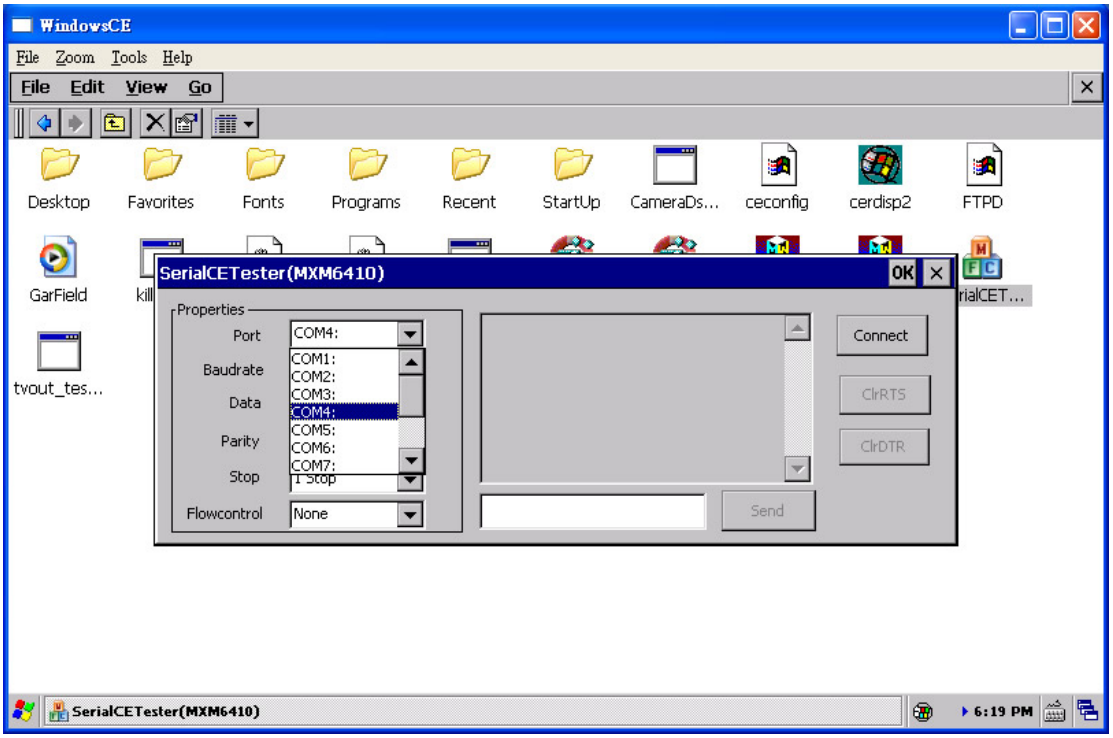
Table 7.3.10. IO Control Codes for COMx

Device Name: COMx:	
IO Control Codes	**Description**
COM_IOCTL_GET_OPERATION_MODE	*This IOCTL is used to get the operation mode.*
COM_IOCTL_SET_OPREATION_MODE	*This IOCTL is used to set the operating mode.*

7.3.10.2. Test COM Ports

To test COM ports, user ActiveSync program to put the SerialCETester.exe that Embedian offered into device \Windows directory and open it. You will see as shown figure 7.3.22.

Figure 7.3.22 COM Port Test Program



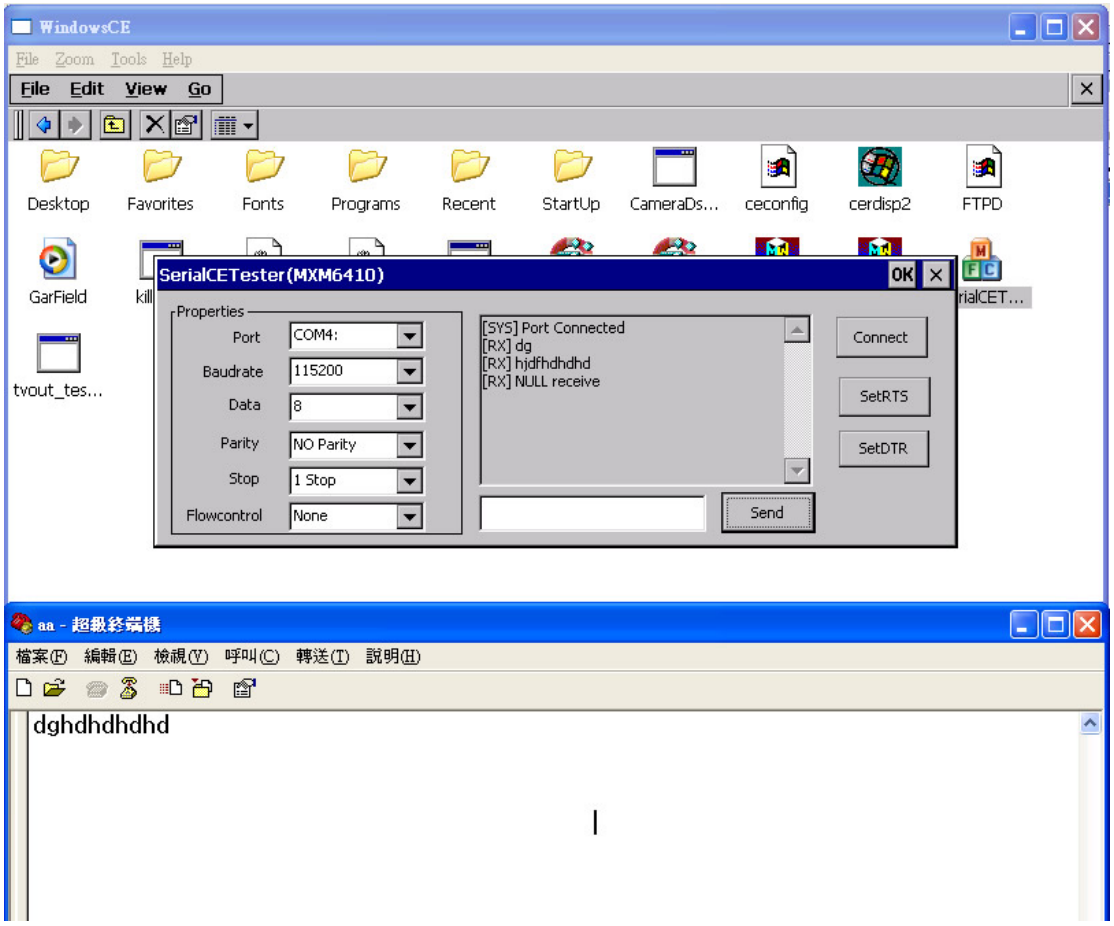
At the PC side, open the hyper terminal program and set the COM port baud rate, configuration and hardware flow control.

At device side, choose which COM port you would like to test and set the COM port baud rate, configuration and hardware flow control exactly the same as that you set in PC Hyperterminal.

Press “Connect” and type and characters from PC. You should be able to receive those characters from the CE device.

Type any characters in the dialog box of the CE test program and then click “Send”. You should be able to receive them in the PC Hyperterminal program. This is shown in figure 7.3.23.

Figure 7.3.23 COM Port Test Result



7.3.11. Software Installation

Applications installed on to the Embedian Windows CE products will not remain on the device after rebooting the system. This is due to the applications being installed to the \Windows and \Program Files folders. The \Windows and \Program Files folders are not persistent. For this reason, users can integrate the software from the platform builder and integrate the software into the NK or users can use the batch file to implement that. The following steps must be taken to restore the files to the \Windows and \Program Files folders.

7.3.11.1. Software Installation using a Batch File

Software Installation

1. Follow the standard installation of the software application to the Windows CE device.
2. Test the software application.
3. From the Desktop run the application and Save the Registry.
4. Connect the Windows CE device to a PC with ActiveSync.
5. Create a folder on your hard drive of the PC.
6. Copy the files from the Windows CE device to the folder on the hard drive.

- Directories to check:

  \Windows
  \Program Files
  \Windows\Programs

7. Create a batch file to copy the files to the Windows CE device.

- Be sure to copy the files to where they were placed during the installation.
- Folders will need to be created on the Windows CE device to match the ones created during the install.

8. Copy all of the files and the batch file on to a SD/SDHC card.
9. Place the SD/SDHC card in to the Windows CE device.

- To debug the batch file place a pause as the last line in the file. Then when the batch file runs you will se the results on the Windows CE device.

10. On the Windows CE device run the batch file.
11. Test your software application.
12. Create a Startup folder in the **\NandFlash** folder.
13. Paste a Shortcut to the batch file on the **StorageCard**.
14. From the Desktop run the application and Save the Registry.
15. Reboot the system.

- The shortcut should run the batch file from the SD/SDHC card.

16. Test your software application.

SAMPLE.BAT

md \Windows\Programs

Copy <filename> \Windows\Programs

md \Program Files\<appname>

Copy <filename> \Program Files\<appname>

Pause

<filename> = the file you wish to copy

<appname> = the application name

md = Make Directory command line function (DOS)

Note1: Once the batch file is debugged remove the Pause from the last line and add Echo off as the first line. Echo off will not display the batch file running.

Note2: The only way to make the applications permanent on the Windows CE device is to create a new Windows CE Operating Systems Image. User can custom your own Windows CE Images by the BSP that Embedian supplied.

7.4. Configure LCD parameters for different kinds of LCDs

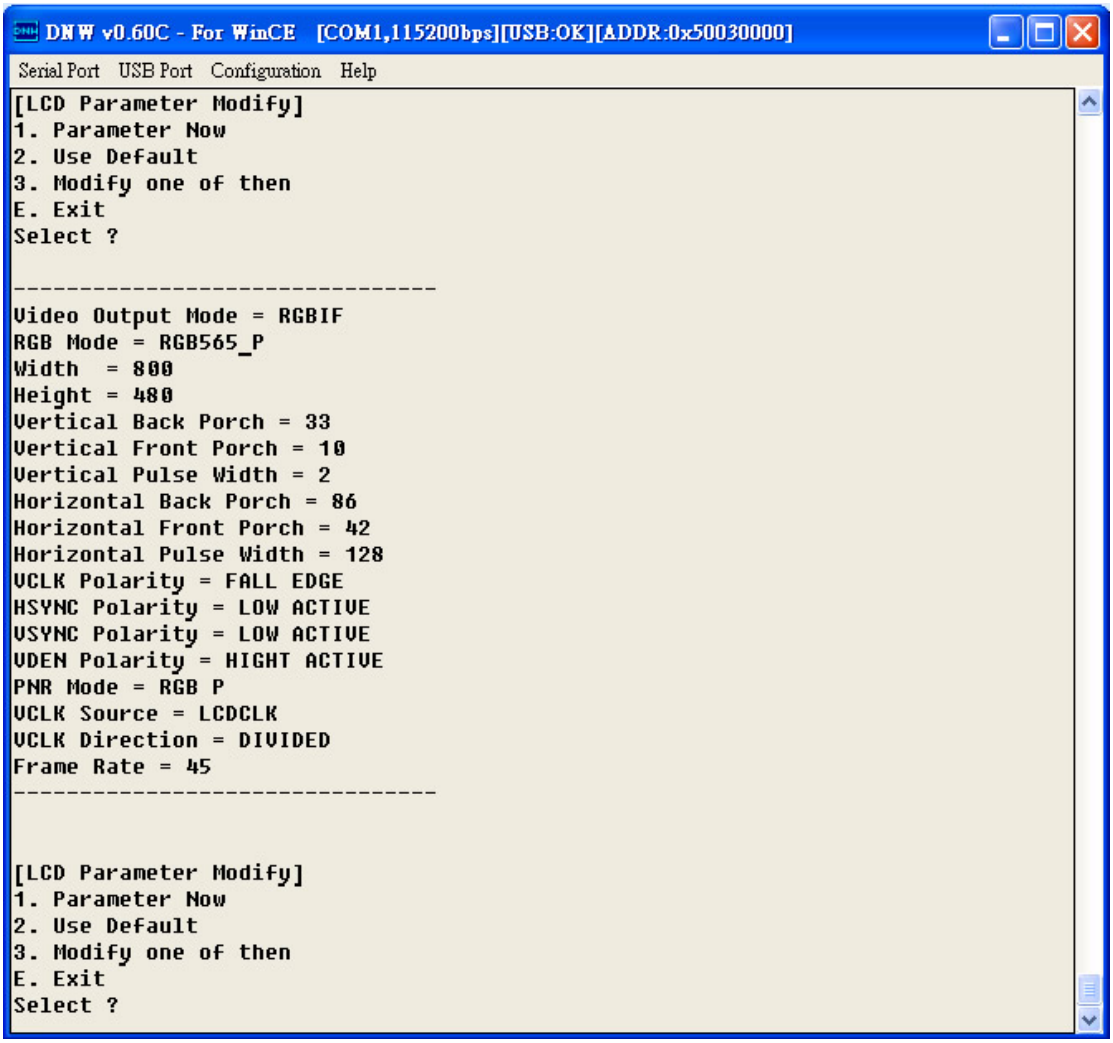
Users don't need to build from BSP to configure LCD parameters of various types. Embedian allow users to configure the LCD parameters at EBOOT menu, after configuring, EBOOT will pass those parameters to NK. Embedian also reserves some very common types LCD parameters as default setting. Users can just choose it instead of setting parameters each by each. Embedian also allow users to view the current LCD parameter settings.

7.4.1. View Current LCD Parameters

To view current LCD parameters, go to EBOOT menu and press "**Z) MXM EVB Board SubTestMenu**" and then press "**2. LCD Panel Parameter Modify**" and then press "**1. Parameter Now**" as shown in figure 7.4.1

.

Figure 7.4.1 View Current LCD Parameters

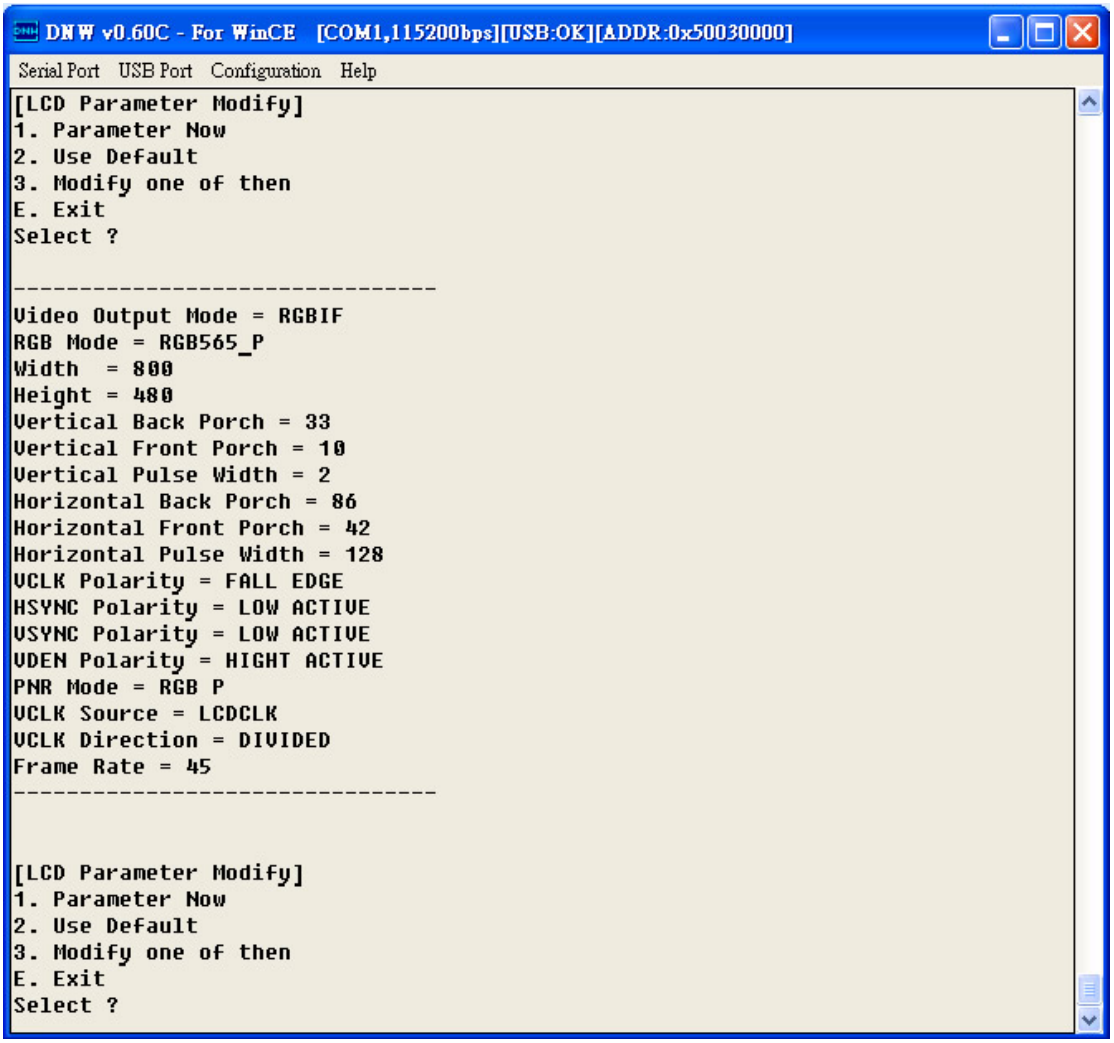


7.4.2. Choose Default LCD Parameters

Embedian chooses Data Image 5.7-inch FG050605DNSWAG01 (320x234) and PVI 7-inch PM070WT3 (800x480) as default LCD parameters because they are also compatible to many LCDs with same resolutions.

To set the default LCD parameters, go to EBOOT menu and press "**Z) MXM EVB Board SubTestMenu**" and then press "**2. LCD Panel Parameter Modify**" and then press "**2. Use Default**". You will see two types of LCD for your choices. Choose the correct type that you will use. Following figure shows the default LCD parameters.

Figure 7.4.2 Default LCD Parameters



To save the configuration, press "**E**" exit to main menu and press "**W) Write Configuration Right Now**" to save it.

7.4.3. Set LCD Parameters of Different Types

Embedian provides users with an easy way to configure parameters for various types of LCDs.

To configure your LCD parameters, go to EBOOT menu and press "**Z) MXM EVB Board SubTestMenu**" and then press "**2. LCD Panel Parameter Modify**" and then press "**3. Modify one of then**". You will see the following menu

[LCD Parameter Modify by each]

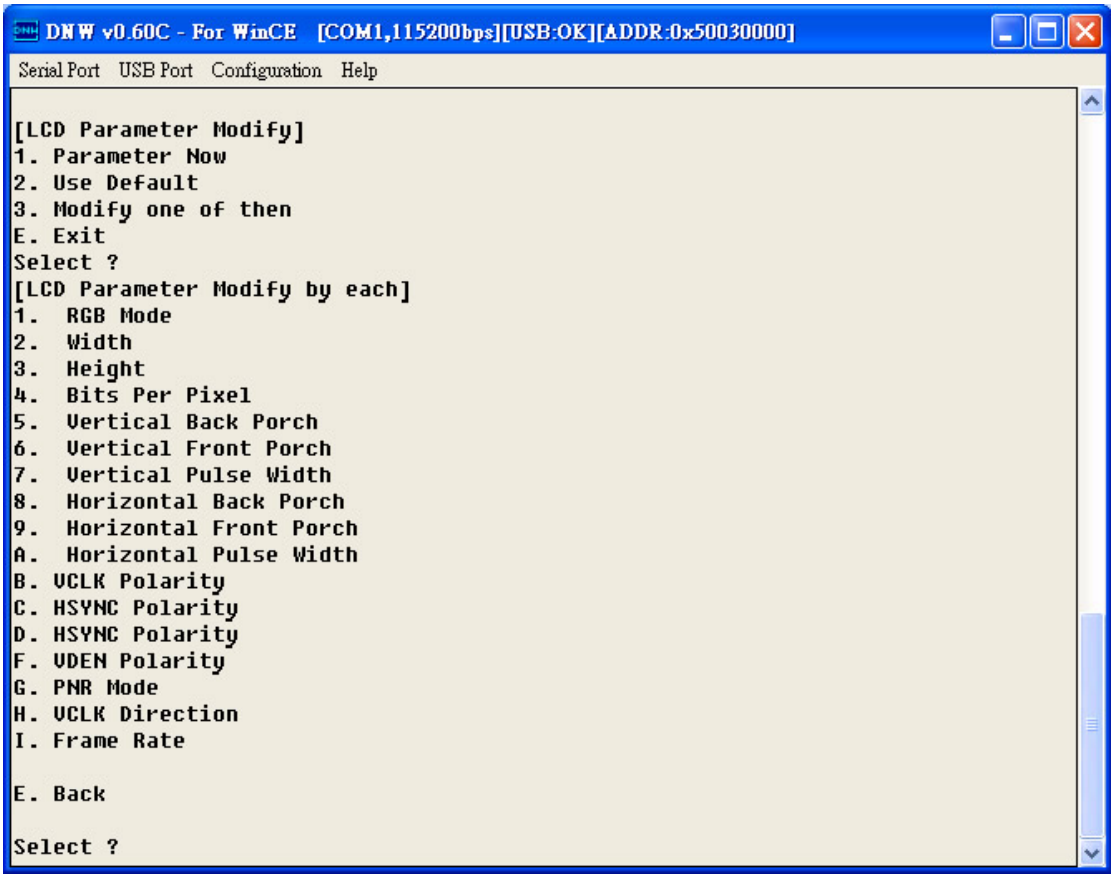
1. **RGB Mode**
2. **Width**

3. **Height**
4. **Bits Per Pixel**
5. **Vertical Back Porch**
6. **Vertical Front Porch**
7. **Vertical Pulse Width**
8. **Horizontal Back Porch**
9. **Horizontal Front Porch**
A. **Horizontal Pulse Width**
B. **VCLK Polarity**
C. **HSYNC Polarity**
D. **HSYNC Polarity**
F. **VDEN Polarity**
G. **PNR Mode**
H. **VCLK Direction**
I. **Frame Rate**

E. Back

You can set each of them by just choose them. Following figure shows the setting of each parameter.

Figure 7.4.3 Configure LCD Parameters



After done with the setting, press "**E**" to exit to the main menu and press "**W**" to save the parameters. The EBOOT will pass the new LCD parameters to NK and you should see the new LCD configuration at next boot.

7.5. Configure GPIOs, BACKLIGHT_EN, LCD_PWREN and VDDLCD_PWREN

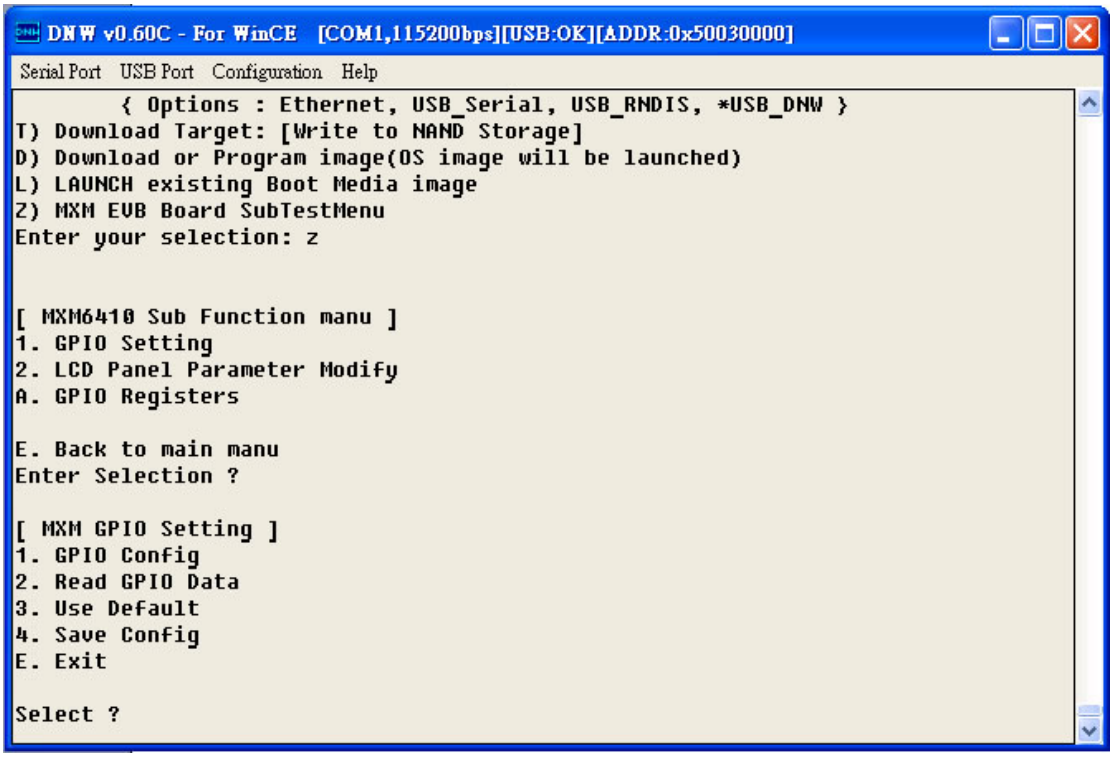
Embedian reserves 12 free available GPIOs as well as BACKLIGHT_EN signal, LCD_PWREN signal and VDDLCD_PWREN for user configuration. Users can set the GPIOs as input or output, high or low, pull-up or pull-down at Eboot or during the NK.

7.5.1. Configure GPIOs Setting at EBOOT

Embedian provides users with an easy way to configure GPIO settings for free available GPIOs at EBOOT.

To configure the GPIO settings, go to EBOOT menu and press "**Z) MXM EVB Board SubTestMenu**" and then press "**1. GPIO Setting**". Users will see GPIO configuration menu as shown in figure 7.5.1.

Figure 7.5.1 GPIO Setting Menus


DNW v0.60C - For WinCE [COM1,115200bps][USB:OK][ADDR:0x50030000]
Serial Port USB Port Configuration Help
{ Options : Ethernet, USB_Serial, USB_RNDIS, *USB_DNW }
T) Download Target: [Write to NAND Storage]
D) Download or Program image(OS image will be launched)
L) LAUNCH existing Boot Media image
Z) MXM EVB Board SubTestMenu
Enter your selection: z
[MXM6410 Sub Function manu]
1. GPIO Setting
2. LCD Panel Parameter Modify
A. GPIO Registers
E. Back to main manu
Enter Selection ?
[MXM GPIO Setting]
1. GPIO Config
2. Read GPIO Data
3. Use Default
4. Save Config
E. Exit
Select ?

The "**1. GPIO Config**" option can let users configure each GPIO pin as input or output, pull-up or pull-down and high or low.

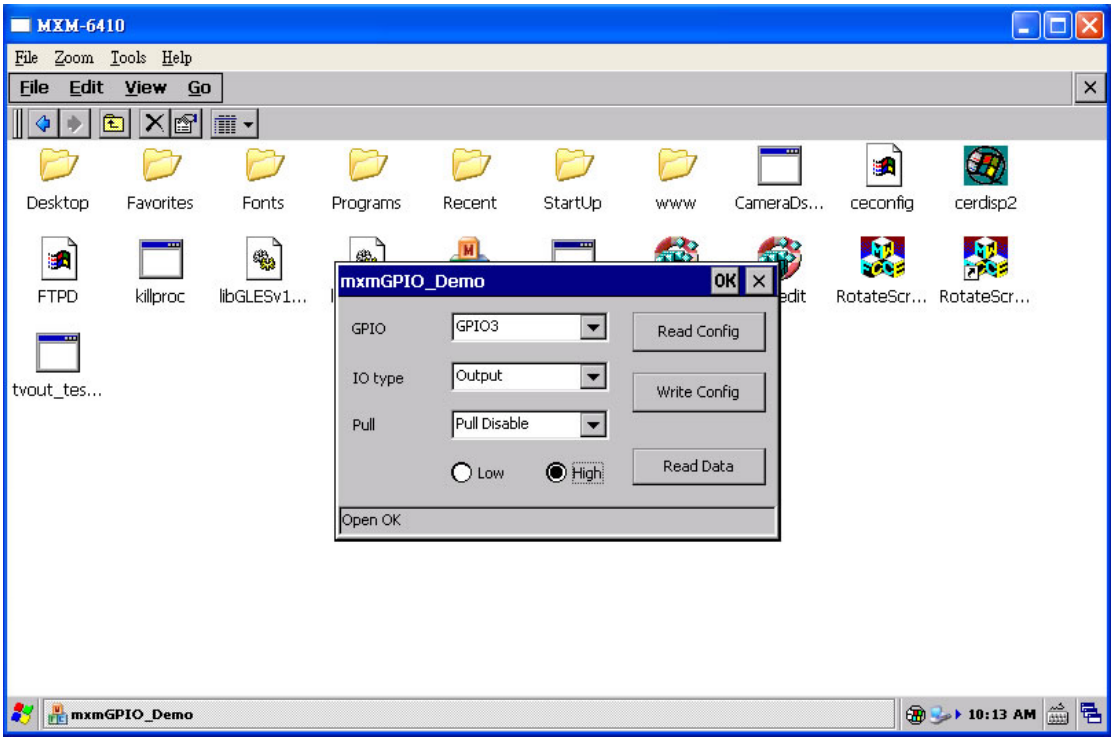
The "**2. Read GPIO Data**" allows users to read the GPIO data if the GPIO is set to be input and connect to the outer world or if the GPIO is set to be output.

The “**3. Use Default**” will set the GPIO 1 to GPIO 12 input pull-down. BACKLIGHT_EN, LCD_PWREN and VDDLCD_PWREN signals are set to output pull-disable high by default.

7.5.2. Configure GPIOs Setting at NK

Embedian provides users with a library and sample demo code to allow user application change the GPIO setting at NK. The control applet named "***mxmGPIO_demo.exe***" provides a simple user interface to diagnostic the functionality of the digital input and digital output channels.

Figure 7.5.2 GPIO Demo Program



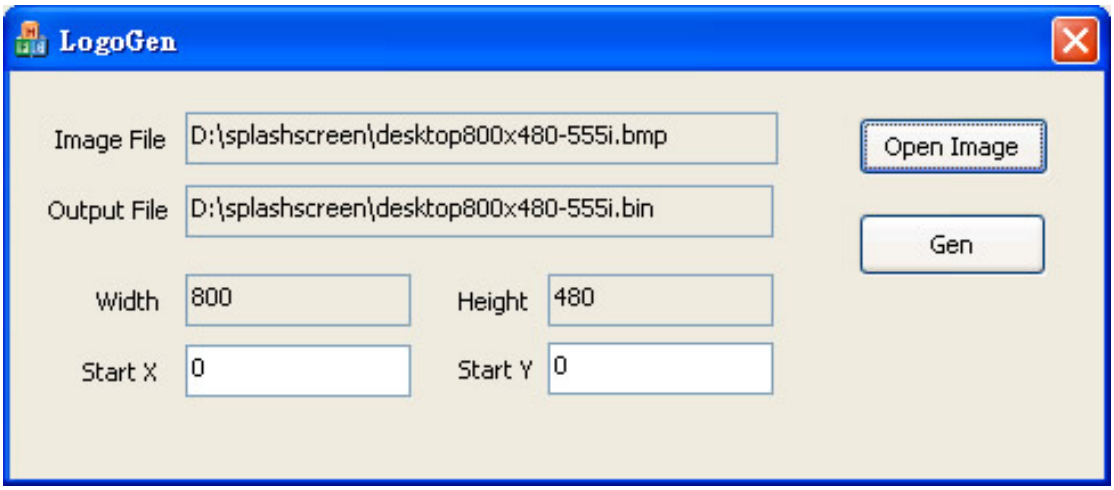
Note:

1. The sample code of the GPIO demo program is available at Embedian FTP site.
2. The "Read Config" button at the right hand side of the program will read back the current GPIO setting.
3. If the IO type is "Output", the "Write Config" button at the right hand side of the program will set the port to "Low" first by default and it will change to high when user click the "High" radio button.
4. When the IO type is set to "Input", users can know the setting of outer world by clicking "Read Data" button.

7.6. Logo Splash Screen Customizer

Embedian provides a way to allow users to customize their own boot splash screen at EBOOT. To achieve that, users need to prepare for a bmp 555i file format first. And then use the “LogoGen.exe” program than Embedian provided to convert the 555i file format into an EBOOT readable .bin file format.

Figure 7.6.1 LogoGen Program

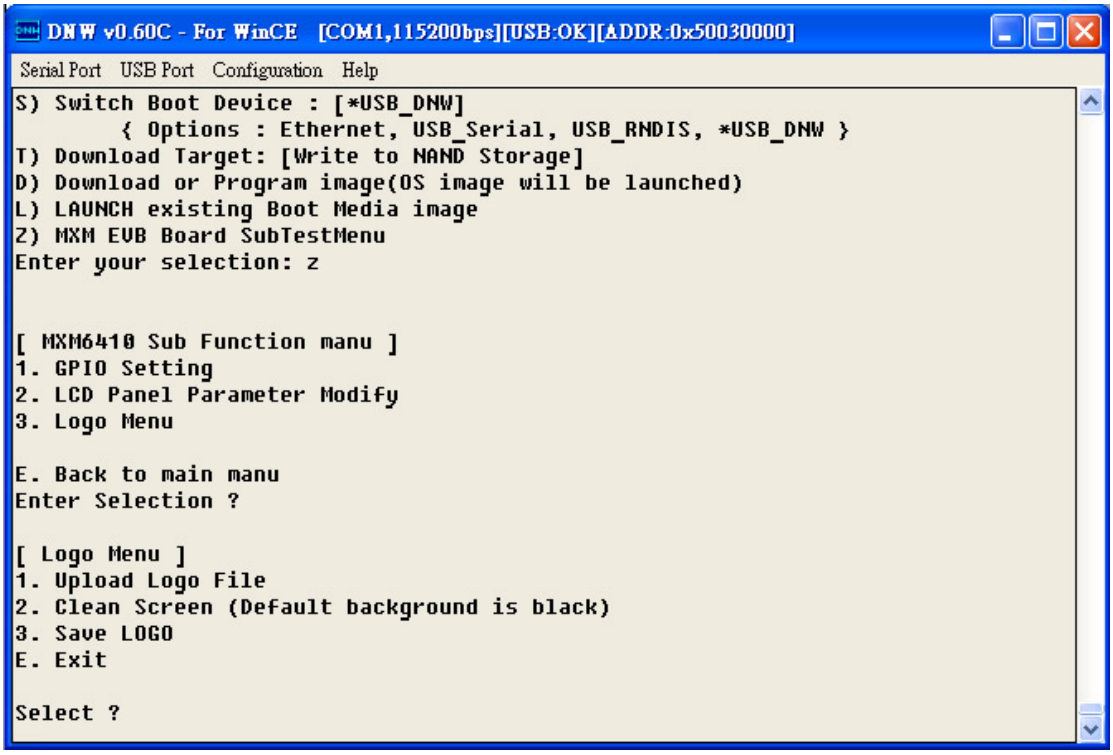


The program allows users set the image width, height, startX and startY parameters and convert to a EBOOT readable .bin file format.

7.6.1. Upload and save splash screen image into devices

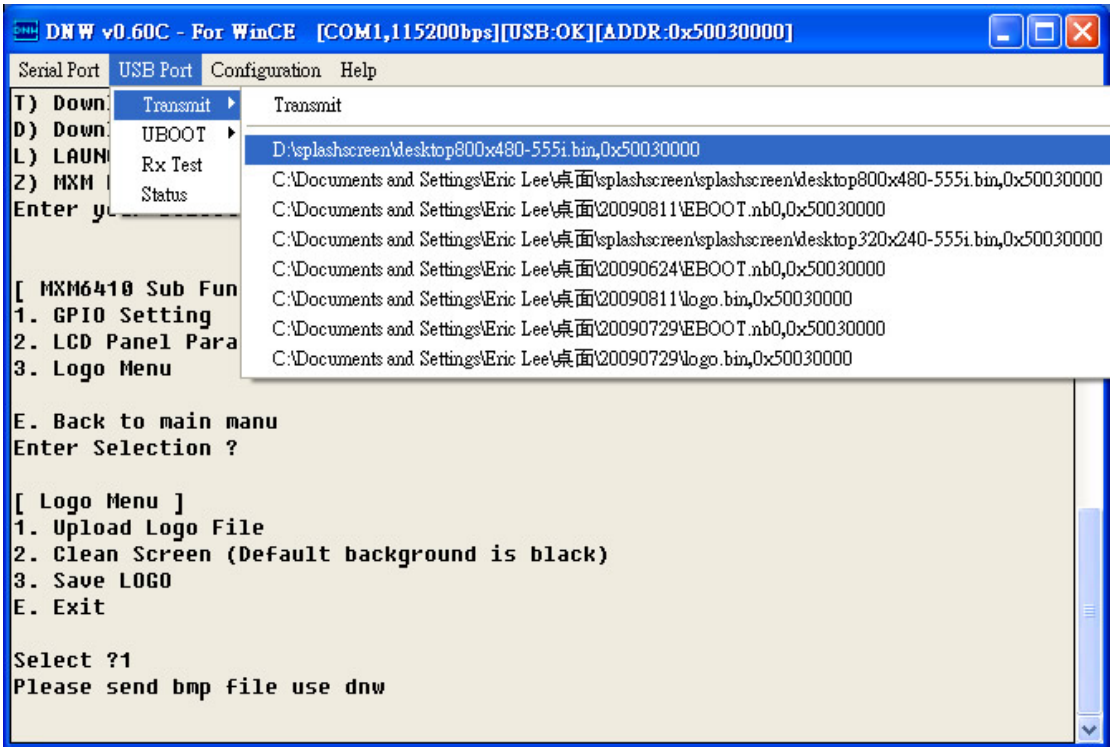
To upload the splash screen image into device, go to EBOOT menu and press “**Z) MXM EVB Board SubTestMenu**” and then press “**3. Logo Menu**”. Users will see sub menu as shown in figure 7.6.2.

Figure 7.6.2 EBOOT LOGO Menu


DNW v0.60C - For WinCE [COM1,115200bps][USB:OK][ADDR:0x50030000]
Serial Port USB Port Configuration Help
S) Switch Boot Device : [*USB_DNW]
{ Options : Ethernet, USB_Serial, USB_RNDIS, *USB_DNW }
T) Download Target: [Write to NAND Storage]
D) Download or Program image(OS image will be launched)
L) LAUNCH existing Boot Media image
Z) MXM EVB Board SubTestMenu
Enter your selection: z
[MXM6410 Sub Function manu]
1. GPIO Setting
2. LCD Panel Parameter Modify
3. Logo Menu
E. Back to main manu
Enter Selection ?
[Logo Menu]
1. Upload Logo File
2. Clean Screen (Default background is black)
3. Save LOGO
E. Exit
Select ?

The "**1. Upload Logo File**" option can let users upload the splash screen that just created into the device and shown on the LCD screen immediately. To achieve that, at "**USB Port**" → "**Transmit**" of DNW program, choose the splach screen that just created and you will see the new splash screen shown on the LCD screen.

Figure 7.6.3 Upload Splash Screen



The "**2. Clean Screen (Default background is black)**" allows users to clean the splash screen that you just uploaded.

The "**3. Save LOGO**" will save the splash screen to NAND flash permanently.

Note: The maximum size of splash screen now is limited at 800x600x2 = 768000Byte. For file larger than this size will erase the EBOOT image.

Reboot the device and you should be able to see the new splash screen.

Figure 7.6.4 New Splash Screen

Next, we would like to give topics related to hardware MFC multimedia function in APC-6410.

7.7. WMV9 Decoder for Windows Media Player

The Windows media player in Windows CE 6.0 devices supports WMV9 hardware decoder. And Microsoft provides with a free WMV9 PC encoding tool to encode the video sources. First of all, we need to encode the video source as WMV9 format.

7.7.1. Encode Video source as WMV9

Users can download the free Windows Media Encoding tool that Microsoft provided with from

http://www.microsoft.com/downloads/details.aspx?FamilyID=5691ba02-e496-465a-bba9-b2f1182cdf24&displaylang=en

The recommended resolutions for APC-6410 hardware MFC is 640x480 or 720x480. And the recommended bit rate is around 2000Kbps or less and

frame rate is 30fps. It will take a while to encode the video sources. After encoding, you should be able to see a .wmv output file at the target directory of your PC.

7.7.2. WMV9 Decoder for Windows Media Player

Using ActiveSync. upload the wmv file into the device **NandFlash** or **Storage Card** directory. At devices, go to **My Device → NandFlash** or **My Device → Storage Card** and double click the file that you just upload. You will see the Media Player software playing the video.

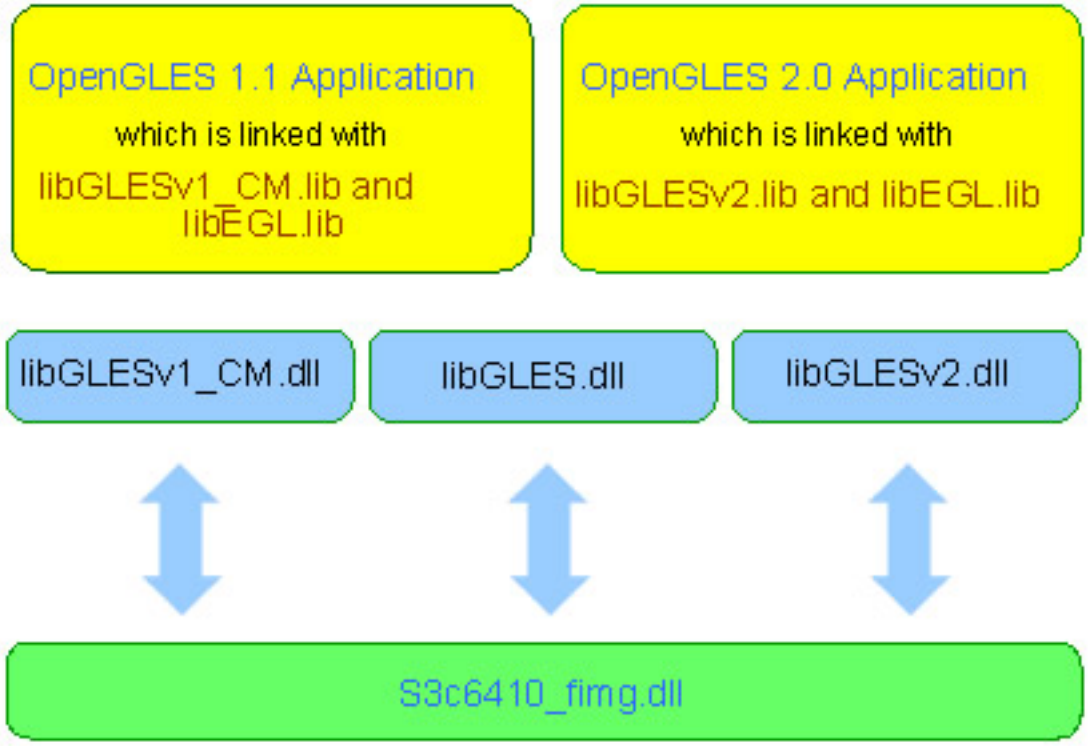
Note: Please remember to close remote display tool when playing video because the remote display tool takes a lot of bandwidth.

7.8. OpenGLES User's Manual

7.8.1. Software Layers

OpenGLES driver has two layers. One is for mapping H/W and allocating memory. The other one is for OpenGLES libraries.

Figure 7.8.1 APC-6410 OpenGLES Software Layer



The Figure 7.8.1 shows this driver structure. S3C6410_fimg.dll is mapping and allocating layer. This driver maps H/W address for library. The library uses this mapped address. And it also allocates physically continuous memory for library and FIMG H/W. If the library requests some texture memory and depth buffer, then this driver dynamically allocates some memory and returns the address.

The libEGL.lib implements EGL 1.3. This will work with OpenGLES1.1 and OpenGLES2.0

The libGLESv1_CM.dll implements OpenGLES1.1. If you want to know more about OpenGLES 1.1, please visit www.opengl.org website.

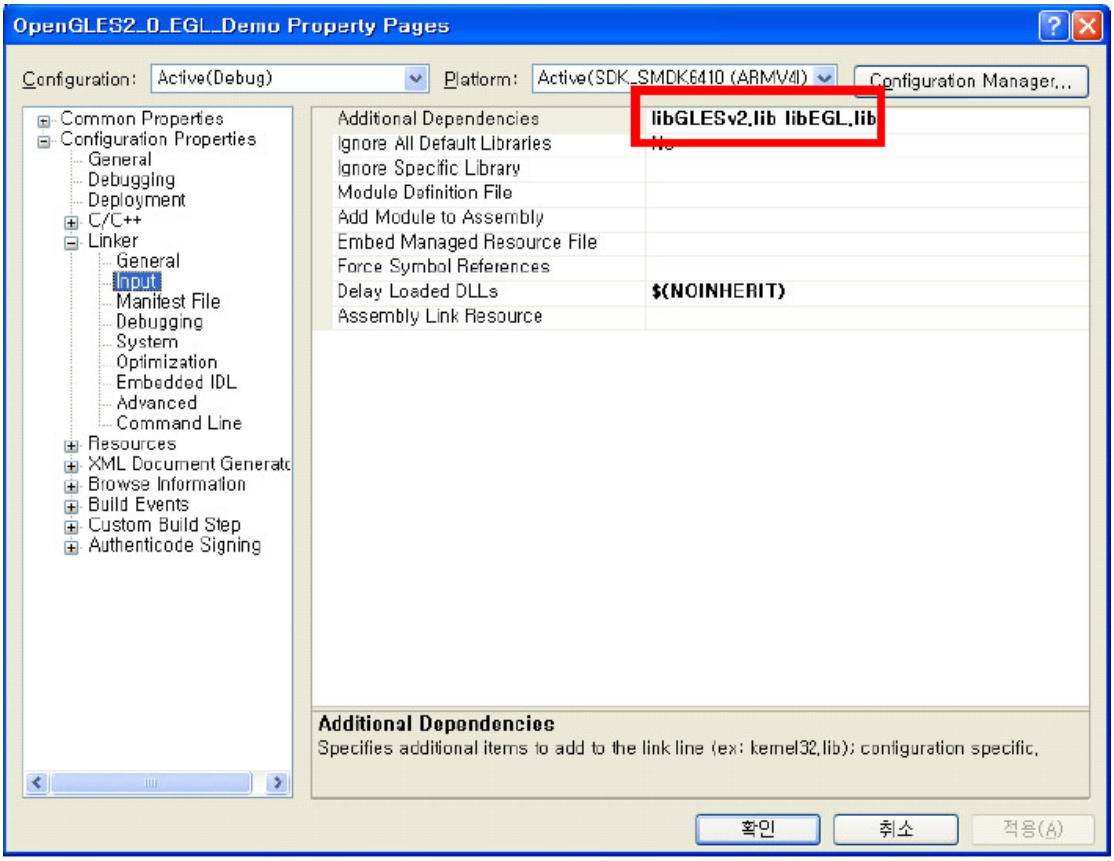
The libGLESv2.dll implements OpenGLES2.0. If you want to know more about OpenGLES 1.1, please visit www.opengl.org website.

7.8.2. Usage

For using OpenGLES, You need to link libEGL.lib and libGLGLESv2.lib libraries.

In Project property of Visual Studio 2005, set Additional Dependency like the following figure 4.2.

Figure 4.2 Setting Property for OPENGLES2.0 in VS2005



If you need to use OpenGLES 1.1, then you need to input libGLESv1_CM.lib instead of libGLESv2.lib.

7.8.3. Shader Compile

You need to use orion compiler for compiling shader. You can execute attached compiler on MS Windows XP and VISTA.

Ex)
orion –O –f <Fragment Shader File>
orion –O –v <Vertex Shader File>
orion –O –a –f <Fragment Shader ASM File>
orion –O –a –v <Fragment Shader ASM File>

If you type just “orion”, you can see more detail information about this shader compiler.

7.8.4. Dll location

libEGL.dll, libGLESv1_CM.dll and libGLESv2.dll should be in \Windows directory or same directory with your application. Second has higher priority.

7.8.5. Samples

7.8.5.1. OpenGLES 1.1 Demo Application

The demo program is located at Embedian ftp site and it is a very simple opengles demo. You can get example about OpenGLES application and compile environment from source code.
You can modify line 80 “int selectedDemo” from 0 to 7.

7.8.5.2. OpenGLES 2.0 Demo Application

The demo program is located at Embedian ftp site and it is a very simple opengles demo. You can get example about OpenGLES application and compile environment from source code.
You can modify line 59 “int selectedDemo” from 0 to 2.

Use APC-6410 Hardware MFC Multimedia Function

This Chapter gives how to use the hardware MFC multimedia function.
Section include：

- MPEG4 Decoder for Mplayer at Device
- MFC Device Driver’s API

Chapter 8 Use APC-6410 Hardware MFC Multimedia Function

This Chapter gives topics related to hardware MFC multimedia function in APC-6410.

8.1. MFC Device Driver's API

API Functions	***Description***
CreateFile	*Create the APC-6410 MFC instance.*
DeviceIoControl	*IOCTL_MFC_MPEG4_DEC_INIT* *IOCTL_MFC_MPEG4_ENC_INIT* *IOCTL_MFC_MPEG4_DEC_EXE* *IOCTL_MFC_MPEG4_ENC_EXE* *IOCTL_MFC_H264_DEC_INIT* *IOCTL_MFC_H264_ENC_INIT* *IOCTL_MFC_H264_DEC_EXE* *IOCTL_MFC_H264_ENC_EXE* *IOCTL_MFC_H263_DEC_INIT* *IOCTL_MFC_H263_ENC_INIT* *IOCTL_MFC_H263_DEC_EXE* *IOCTL_MFC_H263_ENC_EXE* *IOCTL_MFC_VC1_DEC_INIT* *IOCTL_MFC_VC1_DEC_EXE* *IOCTL_MFC_GET_LINE_BUF_ADDR* *IOCTL_MFC_GET_RING_BUF_ADDR* *IOCTL_MFC_GET_FRAM_BUF_ADDR*
CloseHandle	*Close the 6410 MFC instance.*

8.1.1. CreateFile

CreateFile	
Syntax	*HANDLE WINAPI CreateFile(* *LPCTSTR lpFileName,* *DWORD dwDesiredAccess,* *DWORD dwShareMode,* *LPSECURITY_ATTRIBUTES lpSecurityAttributes,* *DWORD dwCreationDisposition,* *DWORD dwFlagsAndAttributes,* *HANDLE hTemplateFile* *);*
Description	This function creates the 6410 MFC instance. Several MFC instance can be made simultaneously. This means that CreateFile function can be called several times in a process (task).
Parameters	*lpFileName [IN] : MFC's device driver name. (L"MFC1:")* *dwDesiredAccess [IN] : GENERIC_READ|GENERIC_WRITE* *dwShareMode [IN] : 0* *lpSecurityAttributes [IN] : NULL* *dwCreationDisposition [IN] : OPEN_EXISTING* *dwFlagsAndAttributes [IN] :* *FILE_ATTRIBUTE_NORMAL* *hTeplateFile [IN] : NULL*
Returns	*HANDLE of the MFC instance*. If it fails, it returns INVALID_HANDLE_VALUE.

8.1.2. DeviceIoControl

DeviceIoControl	
Syntax	*BOOL WINAPI DeviceIoControl(* *HANDLE hDevice,* *DWORD dwIoControlCode,* *LPVOID lpInBuffer,* *DWORD nInBufferSize,* *LPVOID lpOutBuffer,* *DWORD nOutBufferSize,* *LPDWORD lpBytesReturned,* *LPOVERLAPPED lpOverlapped* *);*
Description	Most of functions are developed in ioctl. This system call has many functions which is separated by dwIoControlCode
Parameters	*hDevice [IN] : HANDLE returned by CreateFile() function* *dwIoControlCode [IN] : The control code for the operation. Detailed information will explain below.* *lpInBuffer [IN] : Structure of the MFC argument* *nInBufferSize [IN] : Size of MFC argument structure* *lpOutBuffer [OUT] : NULL* *nOutBufferSize [OUT] : 0* *lpBytesReturned [OUT] : NULL* *lpOverlapped [IN] : NULL*
Returns	If the operation completes successfully, the return value is nonzero. If the operation fails or is pending, the return value is zero.

8.1.3. CloseHandle

CloseHandle	
Syntax	*BOOL WINAPI CloseHandle(* *HANDLE hDevice* *);*
Description	Closes an open MFC's handle.
Parameters	*[IN] hDevice* - HANDLE returned by CreateFile() function
Returns	If the function succeeds, the return value is nonzero. If the function fails, the return value is zero

8.1.4. Control Codes for DeviceIoControl()

IOCTL_MFC_MPEG4_DEC_INIT ***IOCTL_MFC_H263_DEC_INIT*** ***IOCTL_MFC_H264_DEC_INIT*** ***IOCTL_MFC_VC1_DEC_INIT***	
Syntax	*BOOL WINAPI DeviceIoControl(* *HANDLE hDevice,* *DWORD dwIoControlCode,* *LPVOID lpInBuffer,* *DWORD nInBufferSize,* *LPVOID lpOutBuffer,* *DWORD nOutBufferSize,* *LPDWORD lpBytesReturned,* *LPOVERLAPPED lpOverlapped* *);*
Description	It initializes the MFC's instance with the configure stream.
Parameters	*hDevice [IN] : HANDLE returned by CreateFile() function* *dwIoControlCode [IN] : IOCTL_MFC_MPEG4_DEC_INIT,* *IOCTL_MFC_H263_DEC_INIT,* *IOCTL_MFC_H264_DEC_INIT,* *IOCTL_MFC_VC1_DEC_INIT* *lpInBuffer [IN] : Pointer to MFC_DEC_INIT_ARG structure.* *nInBufferSize [IN] : sizeof(MFC_DEC_INIT_ARG)* *lpOutBuffer [OUT] : NULL* *nOutBufferSize [OUT] : 0* *lpBytesReturned [OUT] : NULL* *lpOverlapped [IN] : NULL*
Returns	If the operation completes successfully, the return value is nonzero. If the operation fails or is pending, the return value is zero.

IOCTL_MFC_MPEG4_DEC_EXE ***IOCTL_MFC_H263_DEC_EXE*** ***IOCTL_MFC_H264_DEC_EXE*** ***IOCTL_MFC_VC1_DEC_EXE***	
Syntax	*BOOL WINAPI DeviceIoControl(* *HANDLE hDevice,* *DWORD dwIoControlCode,* *LPVOID lpInBuffer,* *DWORD nInBufferSize,* *LPVOID lpOutBuffer,* *DWORD nOutBufferSize,* *LPDWORD lpBytesReturned,* *LPOVERLAPPED lpOverlapped* *);*
Description	It decodes the stream in the LINE_BUF or RING_BUF.
Parameters	*hDevice [IN] : HANDLE returned by CreateFile() function* *dwIoControlCode [IN] : IOCTL_MFC_MPEG4_DEC_EXE,* *IOCTL_MFC_H263_DEC_EXE,* *IOCTL_MFC_H264_DEC_EXE,* *IOCTL_MFC_VC1_DEC_EXE* *lpInBuffer [IN] : Pointer to MFC_DEC_EXE_ARG structure.* *nInBufferSize [IN] : sizeof(MFC_DEC_EXE_ARG)* *lpOutBuffer [OUT] : NULL* *nOutBufferSize [OUT] : 0* *lpBytesReturned [OUT] : NULL* *lpOverlapped [IN] : NULL*
Returns	If the operation completes successfully, the return value is nonzero. If the operation fails or is pending, the return value is zero.

IOCTL_MFC_GET_LINE_BUF_ADDR ***IOCTL_MFC_GET_RING_BUF_ADDR*** ***IOCTL_MFC_GET_FRAM_BUF_ADDR***	
Syntax	*BOOL WINAPI DeviceIoControl(* *HANDLE hDevice,* *DWORD dwIoControlCode,* *LPVOID lpInBuffer,* *DWORD nInBufferSize,* *LPVOID lpOutBuffer,* *DWORD nOutBufferSize,* *LPDWORD lpBytesReturned,* *LPOVERLAPPED lpOverlapped* *);*
Description	It obtains the address of the LINE_BUF, RING_BUF or FRAM_BUF.
Parameters	*hDevice [IN] : HANDLE returned by CreateFile() function* *dwIoControlCode [IN] :* *IOCTL_MFC_GET_LINE_BUF_ADDR,* *IOCTL_MFC_GET_RING_BUF_ADDR,* *IOCTL_MFC_GET_FRAM_BUF_ADDR* *lpInBuffer [IN]*: Pointer to MFC_GET_BUF_ADDR_ARG structure. *nInBufferSize [IN]* : sizeof(MFC_GET_BUF_ADDR_ARG) *lpOutBuffer [OUT]* : NULL *nOutBufferSize [OUT]* : 0 *lpBytesReturned [OUT]* : NULL *lpOverlapped [IN]* : NULL
Returns	If the operation completes successfully, the return value is nonzero. If the operation fails or is pending, the return value is zero.

8.1.5. Data Structure for Passing the IOCTL Arguments

8.1.5.1. MFC_ENC_INIT_ARG

MFC_ENC_INIT_ARG	
int ret_code	[OUT] Return code
int in_width	[IN] width of YUV420 frame to be encoded
int in_height	[IN] height of YUV420 frame to be encoded
int in_bitrate	[IN] Encoding parameter: Bitrate (kbps)
int in_gopNum	[IN] Encoding parameter: GOP Number (interval of I-frame)
int in_frameRateRes	[IN] Encoding parameter: Frame rate (Res)
int in_frameRateDiv	[IN] Encoding parameter: Frame rate (Divider)

8.1.5.2. MFC_ENC_EXE_ARG

MFC_ENC_EXE_ARG	
int ret_code	[OUT] Return code
int out_encoded_size	[OUT] Length of Encoded video stream

8.1.5.3. MFC_DEC_INIT_ARG

MFC_DEC_INIT_ARG	
int ret_code	[OUT] Return code
int in_strmSize	[IN] Size of video stream filled in STRM_BUF
int out_width	[OUT] width of YUV420 frame
int out_height	[OUT] height of YUV420 frame

8.1.5.4. MFC_DEC_EXE_ARG

MFC_DEC_EXE_ARG	
int ret_code	[OUT] Return code
int in_strmSize	[IN] Size of video stream filled in STRM_BUF

8.1.5.5. MFC_GET_BUF_ADDR_ARG

MFC_DEC_INIT_ARG	
int ret_code	[OUT] Return code
int in_usr_data	[IN] User data for translating Kernel-mode address to Usermode address
int out_buf_addr	[OUT] Buffer address
int out_buf_size	[OUT] Size of buffer address

Appendix I

Linux Firmware Update

This Chapter details how to update Linux firmware in NAND flash.
Section include：

- Firmware Architecture
- Update Firmware from uboot
- Update Firmware from NOR flash

Appendix I APC-6410 Linux Firmware Update

This Chapter details firmware upgrade for APC-6410 when using Linux as the operating systems. The firmware in NAND flash includes uboot, kernel zImage and nandfs image.

A.1. Firmware Architecture

Figure A.1 shows the firmware architecture of Linux in NAND Flash.

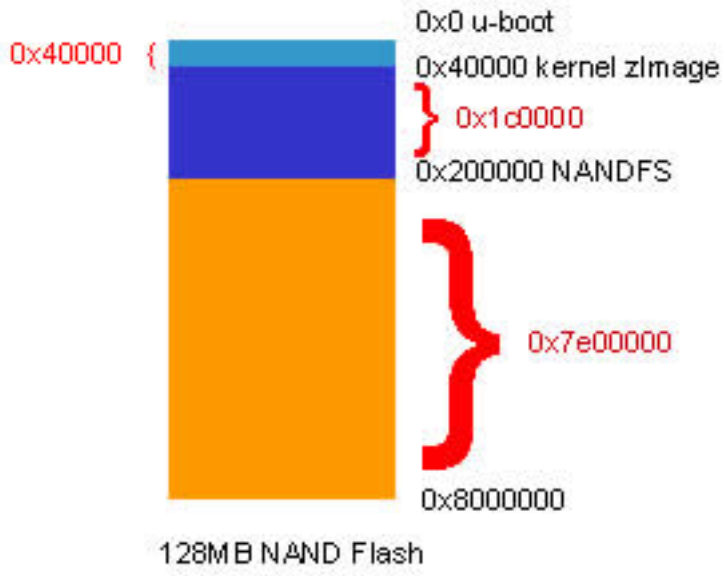


Figure A.1 Firmware Architecture of Linux in NAND Flash

The *uboot.bin* partition starts from NAND address *0x0000000 (0x0)*. The Linux kernel zImage partition starts from NAND address *0x40000*. The NAND filesystem (*nandfs*) is a small ext3 file system for rescue purposed or system that would only need simply application and load the minimum set drivers and this partition starts from the NAND address *0x200000*.

Users need a SD/SDHC card with root file system installed to boot up the complete Ubuntu 9.04 file system. As for how to prepare for an SD/SDHC root file system, this is described at ***Chapter 5***.

Users can update the firmware under uboot or use the onboard NOR flash. The onboard NOR flash is designed for the purpose that when your uboot is erased and cannot boot up anymore. Embedian factory default is firmware pre-installed. Unless necessary, Embedian does not recommend you update firmware (especially uboot) since the system might not boot up anymore if you did the wrong operation. (If you develop your own uboot and kernel, you will need to do that.) Following tells you howto update firmware from uboot

command prompt. The firmware for APC-6410 includes uboot.bin, zImage, and nand6410.img. Now, you are ready to update firmware from uboot. Now, you are ready to update firmware from uboot.

A.2. Update Firmware from uboot

You could use uboot tftp command to download uboot, Linux kernel and NAND root file system. Below we will tell you how to do this under Windows and Linux PC environment. First, you need to set up a tftp server.

A.2.1. Windows Environment

Open up Windows Hyperterminal and set up the serial port (*115200, 8N1*).

A.2.1.1. Setup TFTP Server/Client IP Address from Device

Users need to install tftp server on Windows. You can download the freeware and install to your Windows PC in the **tftproot** directory. Copy the ***uboot.bin***, ***zImage*** and ***nand6410.img*** into this directory. Close your anti-virus software like PC-cillin. (Or close port 69)

First, power on the device with console debug port (UART0, CN20) connected to your PC and Ethernet cable connected to local network and go to uboot command prompt by pressing any key at boot. You will see uboot command prompt like this.

```
In:      serial
Out:     serial
Err:     serial
found DM9000 ID:90000a46
DM9000 work in 16 bus width
MAC: 10:d:32:10:1:12:
Hit any key to stop autoboot:  0
SMDK6410 #
```

You can set and add the *tftp* ip address of the device and server by using "***setenv***", command as below.

```
SMDK6410 # setenv ipaddr <device ip>
SMDK6410 # setenv serverip <server ip>
```

After setting up the ip address, use *saveenv* command to save the configuration. Following figure shows the example for setting up the parameters.
Following figure shows the example for setting up the parameters.

EXAMPLE:

```
SMDK6410 # setenv ipaddr 192.168.1.202
SMDK6410 # setenv serverip 192.168.1.10
SMDK6410 # saveenv
Saving Environment to NAND...
Erasing Nand...Writing to Nand... done
SMDK6410 #
```

Note:
Make sure that the ***server*** ip for Windows PC and ***client*** *ip* for APC-6410 are in the same network domain.

After setting up the IP address and wire everything right, you could start the tftp download.

A.2.1.2. Transfer and Write Image by TFTP and "nand write" Command

After setting up the tftp server and IP address of devices, users can start transfer and write images using uboot *tftp* and *nand write* command. It is necessary to download to DRAM and erase the contents in partition first before writing to NAND.

uboot.bin
The following command shows how to transfer ***uboot.bin*** images to DRAM. To update uboot:

```
SMDK6410 # tftp 50000000 uboot.bin
Found DM9000 ID:90000a46 !
DM9000 work in 16 bus width
[eth_init]MAC:10: d:32:10: 1:12
TFTP from server 192.168.1.10; our IP address is 192.168.1.202
Filename 'uboot.bin'.
Load address: 0x50000000
Loading: T T ################################################
done
Bytes transferred = 196608 (30000 hex)
SMDK6410 #
```

Now, *uboot.bin* file has been uploaded to DRAM temporary address from your PC. Temporary address is base address of DRAM, Default is set to *0x50000000*. From the log, the file size of *uboot.bin* is *196608* bytes (*30000* bytes in HEX).

Write the **uboot.bin** image from DRAM to the NAND by using following *nand write* command. Before writing *uboot.bin* from DRAM to NAND flash, you

need to erase the contents of that partition first by *nand erase* command.

```
SMDK6410 # nand erase 0x0 40000

NAND erase: device 0 offset 0x0, size 0x40000
Erasing at 0x20000 -- 100% complete.
OK
SMDK6410 #
```

This is to erase the NAND flash content in the first partition.

```
SMDK6410 # nand write 0x50000000 0x0 30000

NAND write: device 0 offset 0x0, size 0x30000
 196608 bytes written: OK
SMDK6410 #
```

Temporary address is base address of DRAM, i.e. 0x50000000. Start NAND address is 0x0. Image size of uboot is *0x30000* (HEX) as we have seen previously when tftping.

Note: uboot contains specific hardware information and is well configured by Embedian. It is usually no need to modify. Unless necessary or you are an experienced engineer, it is not recommended to update uboot (uboot.bin). Wrong operation will cause the system not booting up anymore.

zImage

Next example shows how to transfer and write Linux kernel. The file name is "***zImage***". Again, we tftp zImage from PC to DRAM of APC-6410 first by the following command.

```
SMDK6410 # tftp 50000000 zImage
Found DM9000 ID:90000a46 !
DM9000 work in 16 bus width
[eth_init]MAC:10: d:32:10: 1:12
TFTP from server 192.168.1.10; our IP address is 192.168.1.202
Filename 'zImage'.
Load address: 0x50000000
Loading: T #################################################################
         #################################################################
         #################################################################
```

```
         ################################################################
         ################################################################
         ####################
done
Bytes transferred = 1764420 (1aec44 hex)
SMDK6410 #
```

Now, zImage file has been uploaded to DRAM temporary address of APC-6410 from your PC. Temporary address is base address of DRAM, Default is set to *0x50000000*. From the log, we also learned that the file size is*1764420* bytes (*1aec44* bytes in HEX).
Write the zImage image from DRAM to the NAND by using *nand write* command. Again, we need to erase the contents in this partition first.

```
SMDK6410 # nand erase 0x40000 0x200000

NAND erase: device 0 offset 0x40000, size 0x200000
Erasing at 0x220000 -- 100% complete.
OK
SMDK6410 #
```

This is to erase the NAND flash content in the second partition.

```
SMDK6410 # nand write 50000000 0x40000 1af000

NAND write: device 0 offset 0x40000, size 0x1af000
 1765376 bytes written: OK
SMDK6410 #
```

Temporary address is base address of DRAM, i.e. *0x50000000*. Start NAND address is *0x40000*. Image size of zImage is *1b1800* (HEX).

Note:
This image size of *zImage* when tftping is *1aec44 (Hex)*, but the image size we write to NAND flash is*1af000 (Hex)*. This is because the minimum size to write to this NAND flash is 1 page (2K bytes in decimal, 800 bytes in HEX). It is therefore, the image size that writing to NAND flash has to be a multiple of *800*.

nand6410.img

After writing uboot.bin and kernel zImage images to NAND flash, the last step is to write NAND root file system ***nand6410.img*** image. There are some differences from the above uboot.bin and zImage.
The mobile DDR size is 128MB only. If your NANDFS size is big (like Embedian default nand6410.img is 126MB), you need to use *split* command in Linux to split the NANDFS into two smaller files, or the uboot in DRAM will be overwritten because the execution point of uboot is somewhere in DDR. Once you split two smaller files, it will be a good practice for you to flash nandfs into NAND flash. Just remember that the starting address of nandfs partition is *0x200000*. Below is short description. This example split the nan6410.img as a 64MB image and a 62MB image.

```
SMDK6410 # nand erase 200000 7e00000
SMDK6410 # tftp 50000000 nand6410.img.1
SMDK6410 # nand write 50000000 200000 4000000
SMDK6410 # tftp 50000000 nand6410.img.2
SMDK6410 # nand write 50000000 4200000 3e00000
SMDK6410 #
```

After done, reset APC-6410 and the firmware will be updated.

A.2.2 Linux Environment

In this section, we will detail how to transfer and write firmware under Linux PC. First, we need to set up minicom so that we could see the message from the console port.

A.2.2.1. Minicom

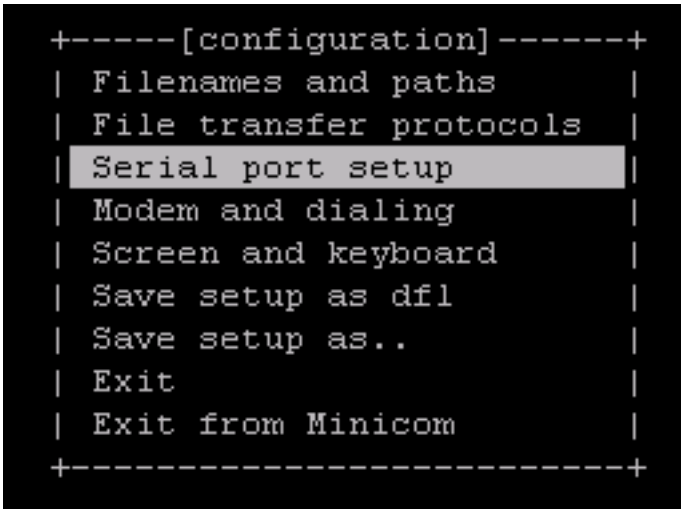
Before transferring images using tftp, you should know how to use Minicom so that you could see the messages from console port. In this section will explain how to setup Minicom.

Desktop Linux has Minicom program for serial communication. It is used for command prompt of uboot or shell prompt of embedded Linux.

Set up the values before using Minicom program. To execute minicom on setting mode:

```
root@dns2:~# minicom -s
```

Figure A.2 Minicom Setup


+-----[configuration]------+
| Filenames and paths |
| File transfer protocols |
| Serial port setup |
| Modem and dialing |
| Screen and keyboard |
| Save setup as dfl |
| Save setup as.. |
| Exit |
| Exit from Minicom |
+--------------------------+

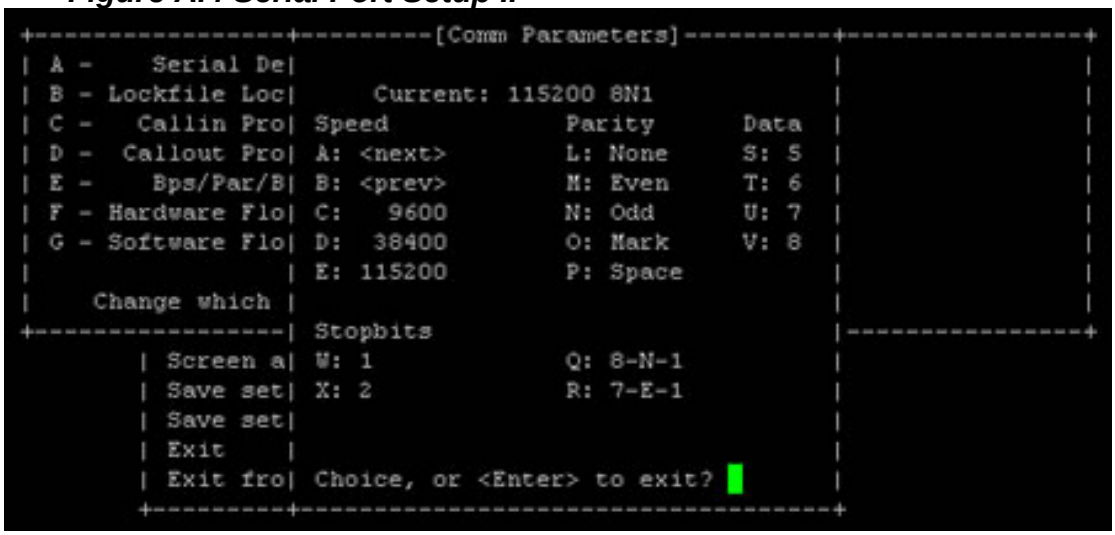
Please select '***Serial port setup***'. Select ***'A***' for setting '***Serial Device***', then type the device descriptor of serial port in your PC which is connected to APC-6410. (You need to figure out the device descriptor of COM port in your Linux PC. In our example, it is ***/dev/ttyS0***)

Figure A.3 Serial Port Setup I

A - Serial Device : /dev/ttyS0
B - Lockfile Location : /var/lock
C - Callin Program :
D - Callout Program :
E - Bps/Par/Bits : 115200 8N1
F - Hardware Flow Control : No
G - Software Flow Control : No
Change which setting?
Screen and keyboard
Save setup as dfl
Save setup as..
Exit
Exit from Minicom

Select '***E***' for setting up '***Bps/Par/Bits***' and enter the next screen. Select '***I***' to set up '***bps***' to **115200**. Select '***V***' to set up '***Data bits***' to **8**. Select '***W***' to set up '***Stop bits***' to '***1***', and '***L***' to set up '***parity***' to '***NONE***'. After done, press, '**Enter**' to save and exit this screen.

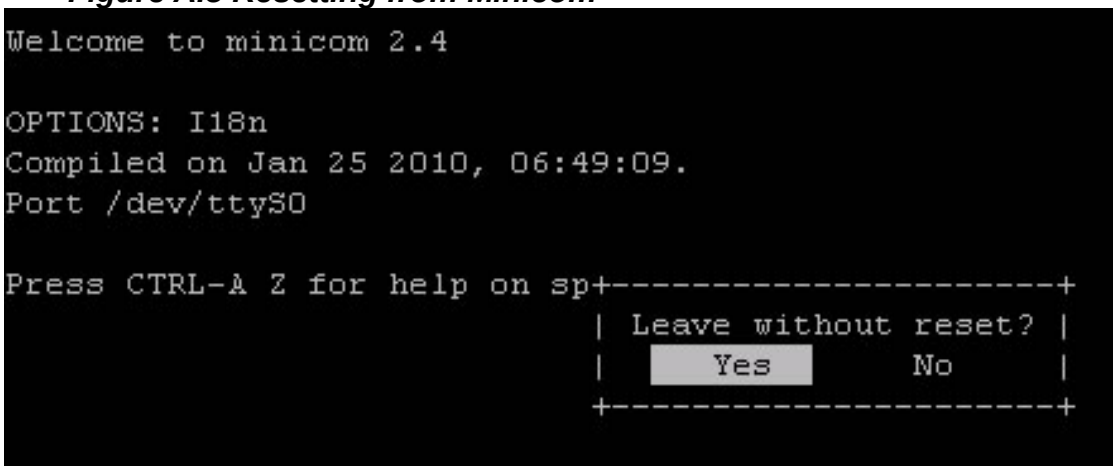
Figure A.4 Serial Port Setup II



Push '***F***' key for setting up '***Hardware Flow Control***' to '***NO***'.
Push '***G***' key for setting up '***Software Flow Control***' to '***NO***'. The default value is '***NO***'. Please refer to figure 3.
Once setting is done, please press '***Enter'*** key. And select '***Save setuo as ..'***. Save the configuration as a *<filename>* then press '***Exit'*** to exit the minicom setup program.

To quit from ***Minicom***, please press **'*Ctrl + A*'** and then **'*Z*'**, at last push **'*Q*'** key. Then Selecting **'*Yes*'**, ***Minicom*** is quitted.

Figure A.5 Resetting from Minicom



To use minicom,

root@dns2:~# minicom < filename>

A.2.2.2. TFTP server in Linux PC

APC-6410 communicates firmware to PC via tftp protocol. It is therefore; you need to install a tftp server first in your Linux PC. This section uses Ubuntu as an example and tells you how to install and set up a tftp server.
First of all, since tftp server is not s stand-alone package, you need to install *tftpd (server)*, *tftp (client)*and *xinetd* packages.

```
root@dns2:~# sudo apt-get install xinetd tftpd tftp
```

Next, create a file called *tftp* under */etc/xinetd.d/* directory.

```
root@dns2:~# sudo vim /etc/xinetd.d/tftp
```

And put this entry:

```
service tftp
{
protocol        = udp
port            = 69
socket_type     = dgram
wait            = yes
user            = nobody
server          = /usr/sbin/in.tftpd
server_args     = /tftpboot
disable         = no
}
```

The last is to make a */tftproot* directory.

```
root@dns2:~# sudo mkdir /tftproot
root@dns2:~# sudo chmod -R 777 /tftproot
```

Start the tftpd through xinetd and you are done.

```
root@dns2:~# sudo /etc/init.d/xinetd start
```

Now you can download compiled images to the APC-6410 by using ***tftp***. Before downloading the images, connect host PC and APC-6410 by Ethernet cable.

To download binary image files to APC-6410, run tftp server service on your computer and put images in ***/tftproot*** directory.

A.2.2.3. Setting up an IP address

Setting up an IP address helps in downloading the compiled images to

APC-6410.
Connect host PC and APC-6410 by Ethernet cable.

A.2.2.3.1. Setting IP address for host PC

On Your Linux Host PC, run the terminal and execute following commands to set up and IP address.

```
[root@localhostt]# ifconfig eth0 down
[root@localhost]# ifconfig eth0 192.168.1.10 netmask 255.255.255.0 up
[root@localhost]# ifconfig
```

A.2.2.3.2. Setting TFTP Server/Client IP address form APC-6410

Below will be exactly the same as that in Windows environment. Copy the ***uboot.bin***, ***zImage*** and ***nand6410.img*** into this directory.

First, power on the device with console debug port (UART0, CN20) connected to your PC and Ethernet cable connected to local network and go to uboot command prompt by pressing any key at boot. You will see uboot command prompt like this.

```
In:      serial
Out:     serial
Err:     serial
found DM9000 ID:90000a46
DM9000 work in 16 bus width
MAC: 10:d:32:10:1:12:
Hit any key to stop autoboot:  0
SMDK6410 #
```

You can set and add the *tftp* ip address of the device and server by using "***setenv***", command as below.

```
SMDK6410 # setenv ipaddr <device ip>
SMDK6410 # setenv serverip <server ip>
```

After setting up the ip address, use *saveenv* command to save the configuration. Following figure shows the example for setting up the parameters.
Following figure shows the example for setting up the parameters.

EXAMPLE:

```
SMDK6410 # setenv ipaddr 192.168.1.202
```

```
SMDK6410 # setenv serverip 192.168.1.10
SMDK6410 # saveenv
Saving Environment to NAND...
Erasing Nand...Writing to Nand... done
SMDK6410 #
```

Note:
Make sure that the ***server*** ip for Windows PC and ***client*** *ip* for APC-6410 are in the same network domain.

After setting up the IP address and wire everything right, you could start the tftp download.

A.2.1.2. Transfer and Write Image by TFTP and "nand write" Command

After setting up the tftp server and IP address of devices, users can start transfer and write images using uboot *tftp* and *nand write* command. It is necessary to download to DRAM and erase the contents in partition first before writing to NAND.

uboot.bin
The following command shows how to transfer ***uboot.bin*** images to DRAM. To update uboot:

```
SMDK6410 # tftp 50000000 uboot.bin
Found DM9000 ID:90000a46 !
DM9000 work in 16 bus width
[eth_init]MAC:10: d:32:10: 1:12
TFTP from server 192.168.1.10; our IP address is 192.168.1.202
Filename 'uboot.bin'.
Load address: 0x50000000
Loading: T T ################################################
done
Bytes transferred = 196608 (30000 hex)
SMDK6410 #
```

Now, *uboot.bin* file has been uploaded to DRAM temporary address from your PC. Temporary address is base address of DRAM, Default is set to *0x50000000*. From the log, the file size of *uboot.bin* is *196608* bytes (*30000* bytes in HEX).

Write the **uboot.bin** image from DRAM to the NAND by using following *nand write* command. Before writing *uboot.bin* from DRAM to NAND flash, you need to erase the contents of that partition first by *nand erase* command.

```
SMDK6410 # nand erase 0x0 40000

NAND erase: device 0 offset 0x0, size 0x40000
Erasing at 0x20000 -- 100% complete.
OK
SMDK6410 #
```

This is to erase the NAND flash content in the first partition.

```
SMDK6410 # nand write 0x50000000 0x0 30000

NAND write: device 0 offset 0x0, size 0x30000
 196608 bytes written: OK
SMDK6410 #
```

Temporary address is base address of DRAM, i.e. 0x50000000. Start NAND address is 0x0. Image size of uboot is *0x30000* (HEX) as we have seen previously when tftping.

Note: uboot contains specific hardware information and is well configured by Embedian. It is usually no need to modify. Unless necessary or you are an experienced engineer, it is not recommended to update uboot (uboot.bin). Wrong operation will cause the system not booting up anymore.

zImage

Next example shows how to transfer and write Linux kernel. The file name is "***zImage***". Again, we tftp zImage from PC to DRAM of APC-6410 first by the following command.

```
SMDK6410 # tftp 50000000 zImage
Found DM9000 ID:90000a46 !
DM9000 work in 16 bus width
[eth_init]MAC:10: d:32:10: 1:12
TFTP from server 192.168.1.10; our IP address is 192.168.1.202
Filename 'zImage'.
Load address: 0x50000000
Loading: T #################################################
         #################################################
         #################################################
         #################################################
```

```
         ###########################################################
         ######################
done
Bytes transferred = 1764420 (1aec44 hex)
SMDK6410 #
```

Now, zImage file has been uploaded to DRAM temporary address of APC-6410 from your PC. Temporary address is base address of DRAM, Default is set to *0x50000000*. From the log, we also learned that the file size is*1764420*bytes (*1aec44* bytes in HEX).
Write the zImage image from DRAM to the NAND by using *nand write* command. Again, we need to erase the contents in this partition first.

```
SMDK6410 # nand erase 0x40000 0x200000

NAND erase: device 0 offset 0x40000, size 0x200000
Erasing at 0x220000 -- 100% complete.
OK
SMDK6410 #
```

This is to erase the NAND flash content in the second partition.

```
SMDK6410 # nand write 50000000 0x40000 1af000

NAND write: device 0 offset 0x40000, size 0x1af000
 1765376 bytes written: OK
SMDK6410 #
```

Temporary address is base address of DRAM, i.e. *0x50000000*. Start NAND address is *0x40000*. Image size of zImage is *1af000* (HEX).

Note:
This image size of *zImage* when tftping is *1aec44 (Hex)*, but the image size we write to NAND flash is*1af000 (Hex)*. This is because the minimum size to write to this NAND flash is 1 page (2K bytes in decimal, 800 bytes in HEX). It is therefore, the image size that writing to NAND flash has to be a multiple of *800*.

nand6410.img

After writing uboot.bin and kernel zImage images to NAND flash, the last step is to write NAND root file system ***nand6410.img*** image. There are some differences from the above uboot.bin and zImage.
The mobile DDR size is 128MB only. If your NANDFS size is big (like Embedian default nand6410.img is 126MB), you need to use *split* command in Linux to split the NANDFS into two smaller files, or the uboot in DRAM will be overwritten because the execution point of uboot is somewhere in DDR. Once you split two smaller files, it will be a good practice for you to flash nandfs into NAND flash. Just remember that the starting address of nandfs partition is *0x200000*. Below is short description. This example split the nan6410.img as a 64MB image and a 62MB image.

```
SMDK6410 # nand erase 200000 7e00000
SMDK6410 # tftp 50000000 nand6410.img.1
SMDK6410 # nand write 50000000 200000 4000000
SMDK6410 # tftp 50000000 nand6410.img.2
SMDK6410 # nand write 50000000 4200000 3e00000
SMDK6410 #
```

After done, reset APC-6410 and the firmware will be updated.

A.3 Update Firmware from NOR flash

The previous section mainly tells you how to update firmware from uboot. Embedian designs a way to recover/update firmware using onboard NOR flash in case that your uboot has been erased for somehow.

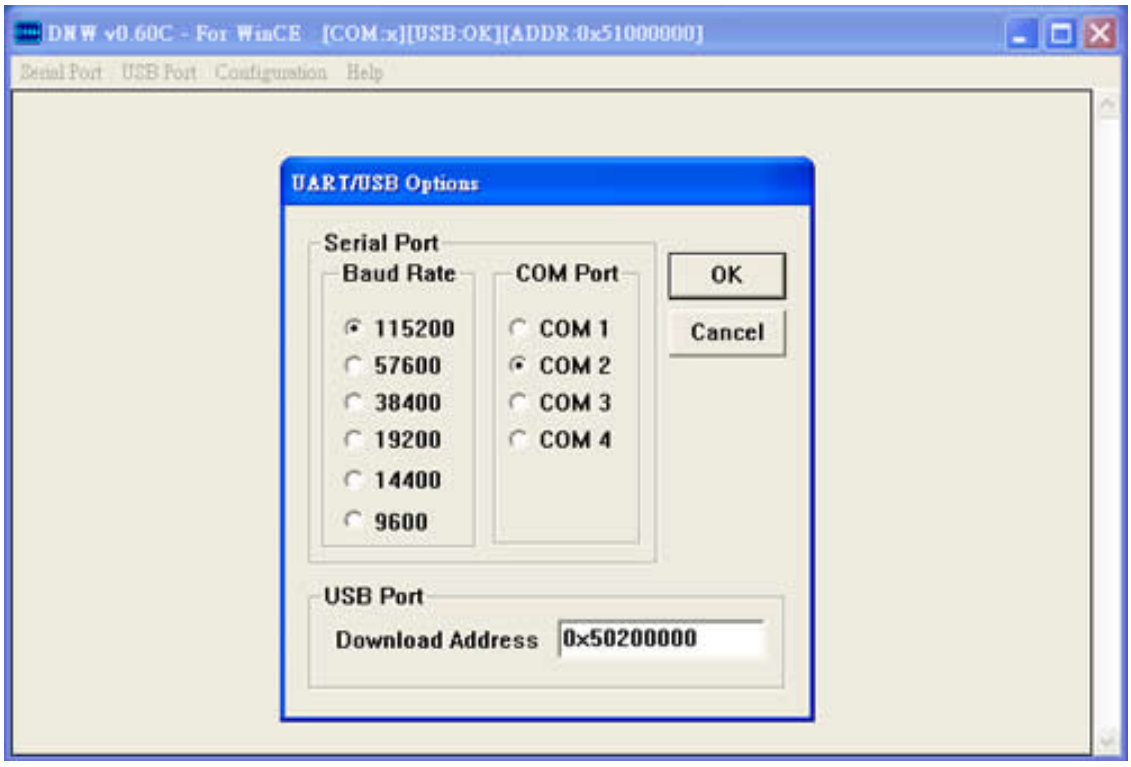
First, power off the device and set the jumper JP1 to NOR flash boot configuration (shunt 1-2). Install the USB driver and DNW programs from Embedian in your host Windows XP PC. Connect the serial console cable from serial console port (UART0, CN20) of device to the COM port of your Windows XP PC. And connect a USB cable from USB device port (CN19) to USB host port of your Windows XP PC.

Open the Hyperterminal program of your Windows PC and set the baud rate as ***115200, 8N1***. Power on the device and you will see the following screen.

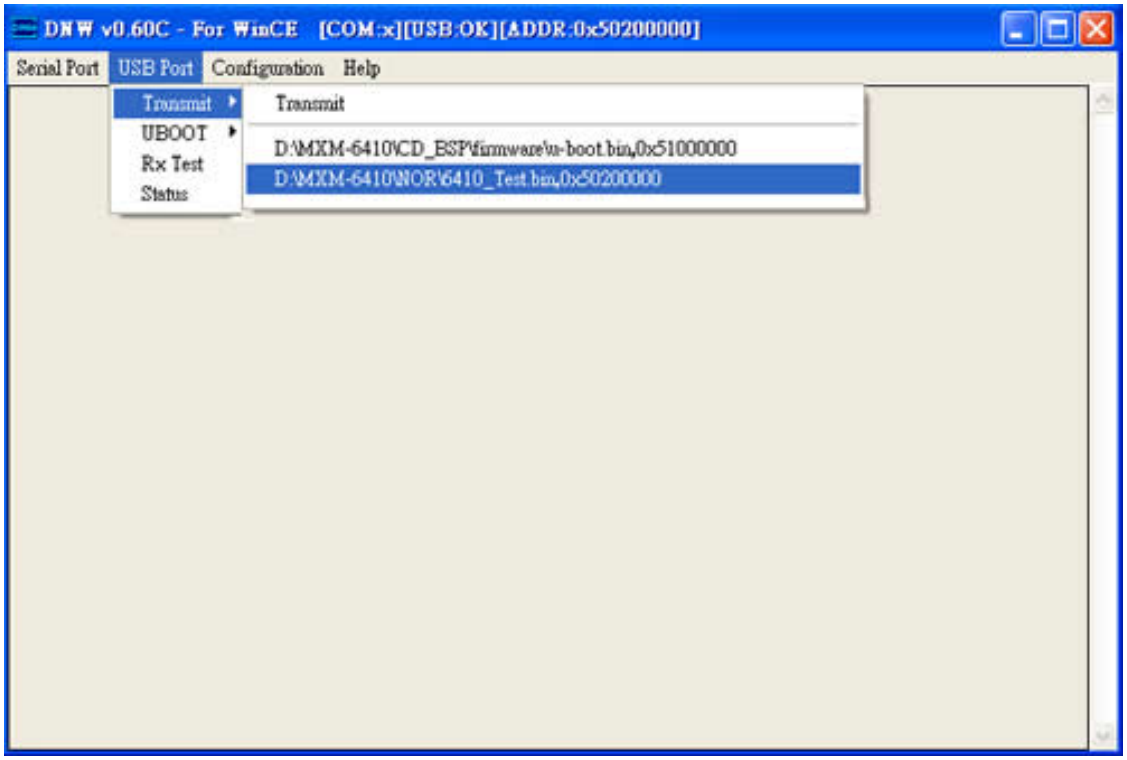
```
+---------------------------------------------+
| S3C6410 USB OTG Downloader v0.2 (2008.07.04)  +
| System ID : Revision [ 0], Pass [ 1]          +
+---------------------------------------------+
ARMCLK: 532.00MHz  HCLKx2: 266.00MHz  HCLK: 133.00MHz  PCLK: 66.50MHz
VIC mode / Sync Mode

USB host is not connected yet.
```

```
Waiting for USB host connection.

!!! USB host is connected !!!
 - Bulk In EP : 1
 - Bulk Out EP : 2
 - Speed : High
 - Op Mode : DMA mode

Download & Run is selected

Select a file to download in DNW
If you want to quit, press any key
```

Open the DNW program on your Windows XP PC, click on ***Configuration → Options*** and set the USB Port Download Address to *0x50200000* as shown in following figure. After done, click ***OK.***



In the DNW program, click on ***USB Port*** --> ***Transmit***, and choose ***6410_Test.bin*** file from your PC. This is shown as the following figure.



This is to load the 6410_Test.bin program to DRAM. This is a program that has many utilities including writing image to NAND flash.
After transmit *6410_Test.bin* program to DRAM, you will see the following screen in your Hyperterminal.

```
*****************************************************
*       S3C6410 - Test firmware v0.1                *
*****************************************************
System ID : Revision [0], Pass [1]
ARMCLK: 532.00MHz  HCLKx2: 266.00MHz  HCLK: 133.00MHz  PCLK: 66.50MHz
VIC mode / Sync Mode

rSPCON: 0xbfcd1500
rGPHCON0: 0x11000000
rGPHCON1: 0x11
rGPHDAT: 0x3c0
 0: SFR R/W Test    1: SYSC_Test       2: DMC_Test        3: SROMC_Test
 4: ONENAND_Test    5: NAND_Test       6: ATA_Test        7: PCCARD_Test
 8: GPIO_Test       9: DMA_Test       10: SBLOCK_Test    11: LCD_Test
12: POST_Test      13: TVENC_Test     14: G2D_Test       15: ROTATOR_Test
```

```
16: CAMERA_Test   17: MFC_Test      18: JPEG_Test     19: MODEM_Test
20: HOSTIF_Test   21: OtgDev_Test   22: SDMMC_Test    23: HSI_Test
24: SPI_Test      25: IIC_Test      26: UART_Test     27: Timer_Test
28: RTC_Test      29: AC97_Test     30: I2S_Test      31: PCM_Test
32: IRDA_Test     33: ADCTS_Test    34: KEYPAD_Test   35: FIMG3D_Test
36: DM9000_Test   37: 16C752B_Test

Select the function to test : 5
```

Enter ***5*** *(5: NAND_Test)*, and you will see the following screen.

```
[NAND_Test]

 0: K9F1208(Normal 8bit)
 1: K9F2G08(Advanced 8bit)
 2: K9HBG08(MLC 8bit)

Select the function to test : 1
```

Enter ***1*** *(1: K9F2G08(Advanced 8bit))*, and you will see the following screen.

```
[NandT_Advanced8bit]
 0: Read ID
 1: Reset command
 2: View Invalid Block
 3: Page Read&Write
 4: Block Erase
 5: Binary program
 6: Lock&Unlock
 7: ECC
 8: IROM Code Function
 9: Performance
10: Full Function

Select the function to test : 4
```

We would like to erase the contents in NAND flash first. Enter ***4*** *(4: Block Erase)*, and you will see the following screen.

```
[NANDT_Erase]

 0: Single Block Erase
 1: Multi Block Erase
 2: Non_Check Invalid Data Single block erase
 3: Non_Check Invalid Data Multi block erase

Select the function to test : 3
```

Enter ***3*** *(3: Non_Check Invalid Data Multi block erase)*, and you will see the following screen.

```
[NANDT_EraseMultiBlock]
Input the Start Block Number to erase the multi-block[multiples of 2 :
0~2047]0
```

At the *Input the Start Block Number to erase the multi-block*, enter ***0***.
At the *Input the Block Number to erase the multi-block*, enter ***2048*** as shown in the following screen.

```
[NANDT_EraseMultiBlock]
Input the Start Block Number to erase the multi-block[multiples of 2 :
0~2047]0
Input the Block Number to erase[multiples of 2 : 2~2048]2048
Skip invalid block #780
Skip invalid block #1804
NAND Erase Block[0 ~ 2047 Block] : Success


 0: Single Block Erase
 1: Multi Block Erase
 2: Non_Check Invalid Data Single block erase
 3: Non_Check Invalid Data Multi block erase

Select the function to test :
```

Press ***Enter*** to exit to the previous screen and to the main screen.

```
*********************************************************
*       S3C6410 - Test firmware v0.1                    *
*********************************************************
System ID : Revision [0], Pass [1]
ARMCLK: 532.00MHz  HCLKx2: 266.00MHz  HCLK: 133.00MHz  PCLK: 66.50MHz
VIC mode / Sync Mode

rSPCON: 0xbfcd1500
rGPHCON0: 0x11000000
rGPHCON1: 0x11
rGPHDAT: 0x3c0
 0: SFR R/W Test   1: SYSC_Test      2: DMC_Test       3: SROMC_Test
 4: ONENAND_Test   5: NAND_Test      6: ATA_Test       7: PCCARD_Test
 8: GPIO_Test      9: DMA_Test      10: SBLOCK_Test   11: LCD_Test
12: POST_Test     13: TVENC_Test    14: G2D_Test      15: ROTATOR_Test
16: CAMERA_Test   17: MFC_Test      18: JPEG_Test     19: MODEM_Test
20: HOSTIF_Test   21: OtgDev_Test   22: SDMMC_Test    23: HSI_Test
24: SPI_Test      25: IIC_Test      26: UART_Test     27: Timer_Test
28: RTC_Test      29: AC97_Test     30: I2S_Test      31: PCM_Test
32: IRDA_Test     33: ADCTS_Test    34: KEYPAD_Test   35: FIMG3D_Test
36: DM9000_Test   37: 16C752B_Test

Select the function to test : 21
```

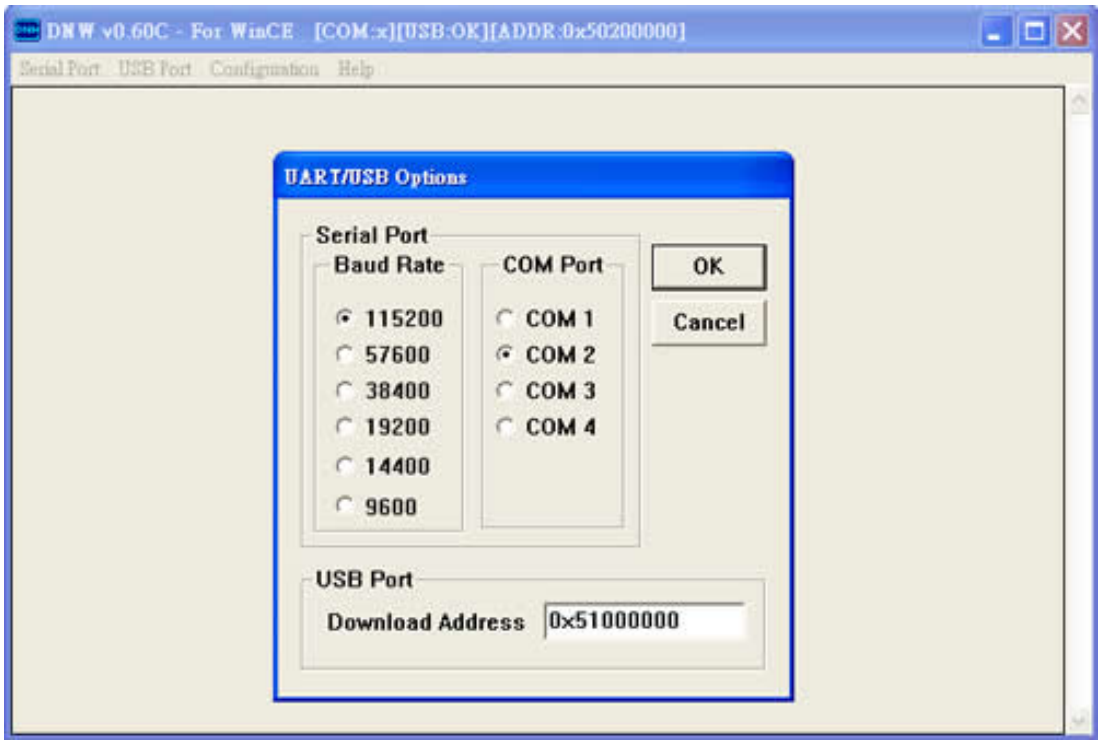
Select ***21*** *(21: OtgDev_Test)* and you will see the following screen.

```
Select the function to test : 21


 0: Donwload Only
 1: Upload Only
 2: Select Op Mode

Select the function to test : 0
```

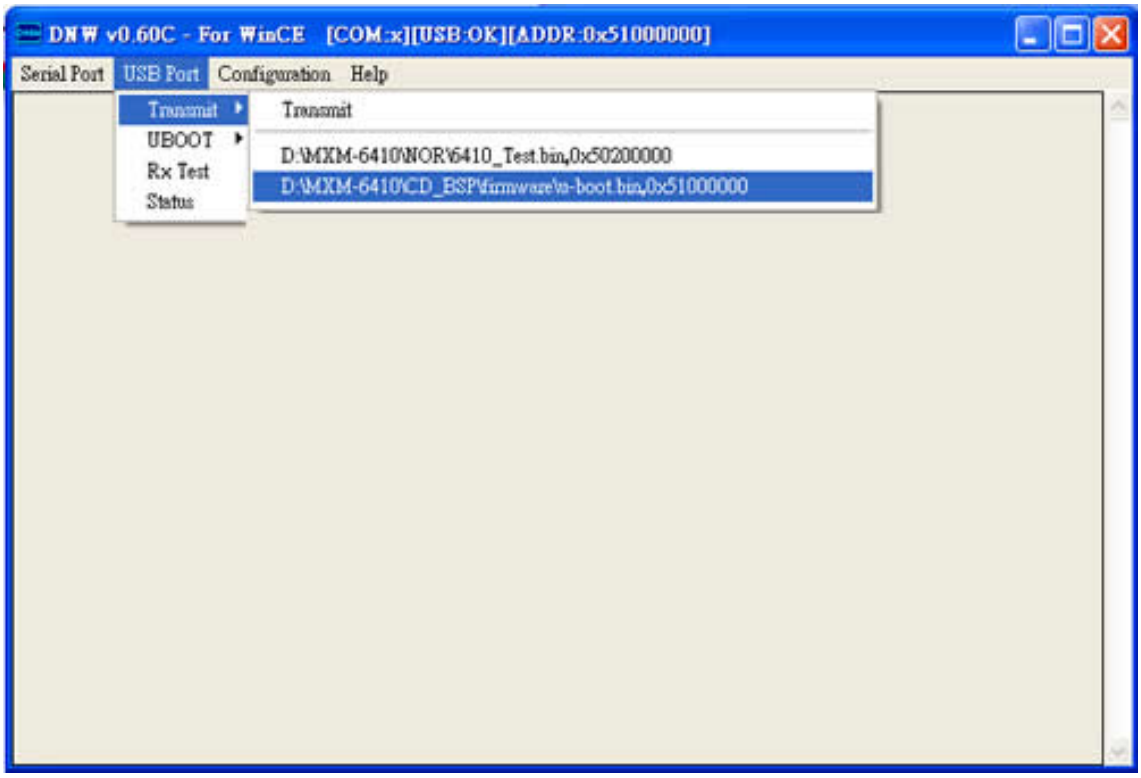
You will be asking to enter the temporary download address. Enter 0x51000000 as following screen.

```
Enter the download address(0x...):0x51000000
The temporary download address is 0x51000000.


!!! USB host is connected (Speed : High) !!!

The temporary download address is 0x51000000.

Select a file to download in DNW
If you want to quit, press ' x' key
```

Next, we need to transmit the *uboot.bin* file to DRAM first. At the DNW program, click on ***Configuration*** → ***Options*** again and set the *USB Port Download Address* to *0x51000000* as shown in following figure. After done, click ***OK***.



In the DNW program, click on ***USB Port → Transmit***, and choose *uboot.bin* file from your PC. This is shown as the following figure.



You will see the following screen in your Hyperterminal.

```
If you want to quit, press 'x' key

[ADDRESS:51000000h,TOTAL:196618(0x30000)]

Checksum is being calculated....
(If you want to skip, press 'x' key)

Checksum O.K.


 0: Donwload Only
 1: Upload Only
 2: Select Op Mode

Select the function to test :
```

The uboot now has been uploaded to the DRAM. Next, we would like to fuse the uboot to NAND flash. Press ***Enter*** to exit to the previous screen and to the main screen.

```
*********************************************************
*       S3C6410 - Test firmware v0.1                    *
*********************************************************
System ID : Revision [0], Pass [1]
ARMCLK: 532.00MHz  HCLKx2: 266.00MHz  HCLK: 133.00MHz  PCLK: 66.50MHz
VIC mode / Sync Mode

rSPCON: 0xbfcd1500
rGPHCON0: 0x11000000
rGPHCON1: 0x11
rGPHDAT: 0x3c0
 0: SFR R/W Test   1: SYSC_Test      2: DMC_Test       3: SROMC_Test
 4: ONENAND_Test   5: NAND_Test      6: ATA_Test       7: PCCARD_Test
 8: GPIO_Test      9: DMA_Test      10: SBLOCK_Test   11: LCD_Test
12: POST_Test     13: TVENC_Test    14: G2D_Test      15: ROTATOR_Test
16: CAMERA_Test   17: MFC_Test      18: JPEG_Test     19: MODEM_Test
20: HOSTIF_Test   21: OtgDev_Test   22: SDMMC_Test    23: HSI_Test
24: SPI_Test      25: IIC_Test      26: UART_Test     27: Timer_Test
28: RTC_Test      29: AC97_Test     30: I2S_Test      31: PCM_Test
32: IRDA_Test     33: ADCTS_Test    34: KEYPAD_Test   35: FIMG3D_Test
36: DM9000_Test   37: 16C752B_Test

Select the function to test : 5
```

Select ***5*** *(5: NAND_Test)* and you will see the following screen.

```
Select the function to test : 5

[NAND_Test]

 0: K9F1208(Normal 8bit)
 1: K9F2G08(Advanced 8bit)
 2: K9HBG08(MLC 8bit)

Select the function to test : 1
```

Select ***1*** *(1: K9F2G08(Advanced 8bit))* and you will see the following screen.

```
Select the function to test : 1


[NandT_Advanced8bit]
 0: Read ID
 1: Reset command
 2: View Invalid Block
 3: Page Read&Write
 4: Block Erase
 5: Binary program
 6: Lock&Unlock
 7: ECC
 8: IROM Code Function
 9: Performance
10: Full Function

Select the function to test : 5
```

Select ***5*** *(5: Binary program)* and you will see the following screen.

```
Select the function to test : 5

[NANDT_ProgramBinary]

Caution : You must put BINARY file into 0x51000000 before programming
Input the Block Number to write[0~2047]
```

At *Input the Block Number to write[0~2047]*, enter ***0***
At *Input the Page Number to write[0~63]*, enter ***0***
At *Input the Size to program[Bytes] :*, enter ***196618***
This is shown as following.

```
Input the Block Number to write[0~2047]0
Input the Page Number to write[0~63]0
Input the Size to program[Bytes] : 196618
.
NAND Program Complete

 0: Read ID
 1: Reset command
 2: View Invalid Block
 3: Page Read&Write
 4: Block Erase
 5: Binary program
 6: Lock&Unlock
 7: ECC
 8: IROM Code Function
 9: Performance
10: Full Function

Select the function to test :
```

Now, you have successfully write uboot.bin into NAND flash. You can remove the jumper block on JP1 and you will see the uboot booting up.

```
K

U-Boot 1.1.6 (Sep 30 2009 - 16:59:05) for SMDK6410


CPU:       S3C6410@666MHz
           Fclk = 666MHz, Hclk = 133MHz, Pclk = 66MHz, Serial = CLKUART
(ASYNC Mode)
Board:     SMDK6410
DRAM:      128 MB
Flash:     0 kB
NAND:      128 MB
```

```
*** Warning - bad CRC or NAND, using default environment

In:      serial
Out:     serial
Err:     serial
found DM9000 ID:90000a46
DM9000 work in 16 bus width
MAC: 10:d:32:10:1:12:
Hit any key to stop autoboot:  0
SMDK6410 #
```

Once the uboot is up, you can use uboot *tftp* to update other firmware as mentioned in previous section.
You can also keep updating zImage and nand6410.img in this way. Just remember to put the correct input target block number and file size.

Windows CE 6.0 Firmware Update

This Chapter details how to update Windows CE 6.0 firmware in NAND flash.
Section include：

- Firmware Architecture
- Restore Stepldr and EBOOT from NOR flash
- Restore NK image from EBOOT
- Restore firmware in NAND flash from SD Boot

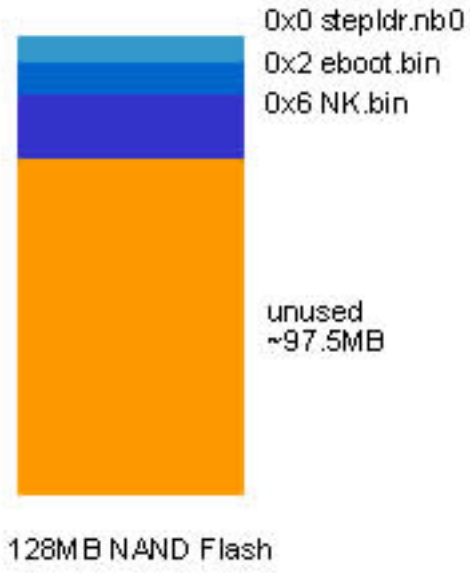
Appendix II APC-6410 Windows CE 6.0 Firmware Update

This Chapter details firmware upgrade for APC-6410 when using Windows CE 6.0 as the operating systems. The firmware in NAND flash includes stepldr.nb0, eoot.bin and NK.bin image.

A.2.1 Firmware Architecture in NAND flash

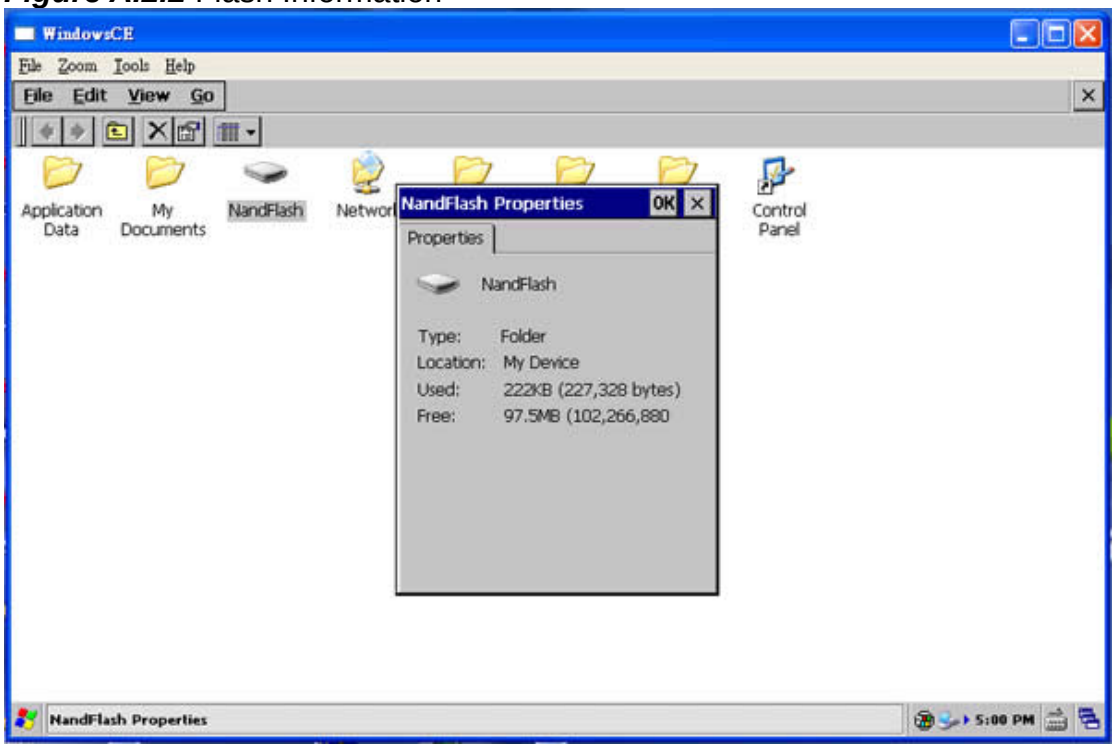
Figure A.2.1 shows the firmware architecture in NAND flash.

Figure A.2.1 Firmware Architecture in NAND Flash



When power on, the processor will copy the first 4K of BootStrap Loader (stepldr.nb0) to internal RAM. The stepldr will initialize the memory mapping and load the eboot from the 2nd block (0x2, 1 block = 128K) of NAND flash. The WinCE 6.0 kernel (NK.bin) starts from the 6th block (0x6). There are about 97.5MB un-used in NAND for users. User can see the flash information at My Device\NandFlash when booting up. Click the mouse or touch on the icon for a few seconds and tab the “Properties” as Figure A.2.2.

Figure A.2.2 Flash Information



The purposes of this document are to tell users how to restore or upgrade the firmware in NAND flash. The next section will detail that. There are two ways to do this. One way is from the one-board NOR flash and the other way is from SD boot.

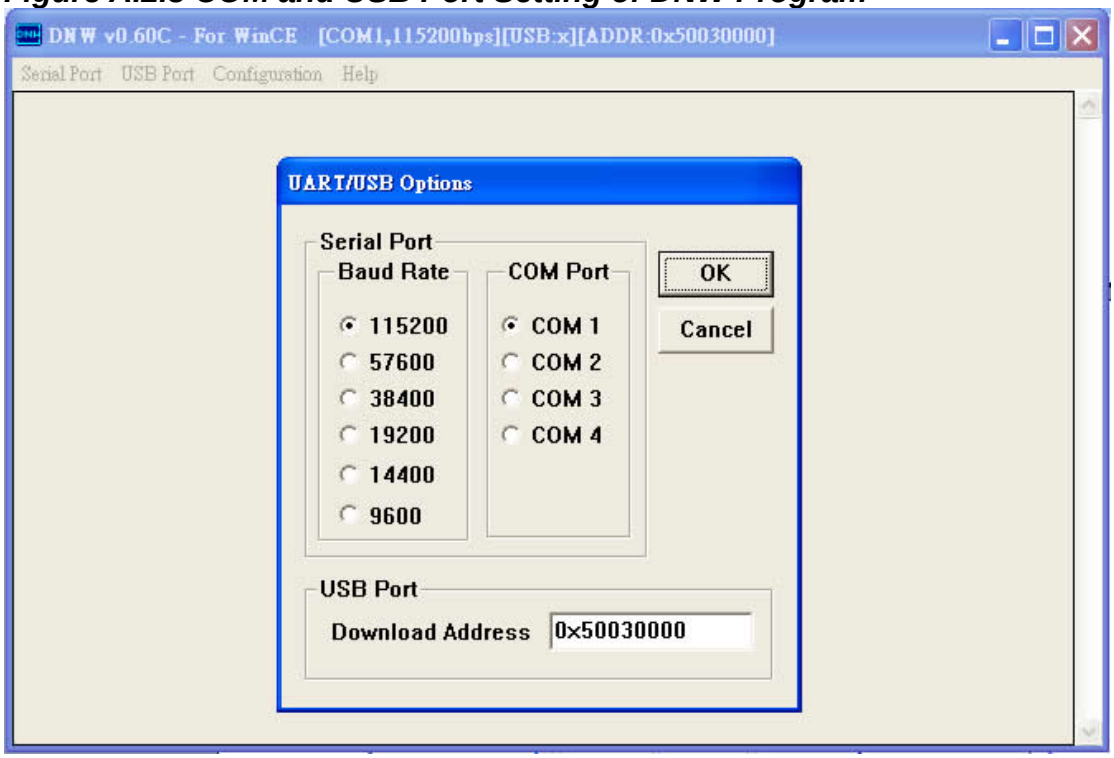
A.2.2 Restore Stepldr and EBOOT from NOR flash

User will need this chapter in case that your EBOOT is erased by accident or gone for somehow. To write Stepldr and EBOOT images to NAND flash using NOR boot, first, power off device and set the jumper JP1 to NOR flash configuration. (Be sure to power off the system before you changing the jumper.)

Install the USB host driver to your Windows system and DNW v0.6C programs that Embedian provided in your host Windows PC. Connect the serial console cable from serial console port (UART 0 in CN20 of Embedian SBC) of device to the COM port of your Windows PC. And connect a USB cable from USB device port (CN19 of Embedian SBC) to USB host port of your Windows PC.

In "**Serial Port**" of your dnw program, click on "**Connect**" and power on device. In "**Configuration**" of dnw program, at "**Options**" set the COM port as the following setting of figure A.2.3. And the USB Port Download Address is "***0x50030000***", this is the DDR DRAM address where the program will be executed. The baud rate is 115200 and the host COM port is this example is "**COM 1**"

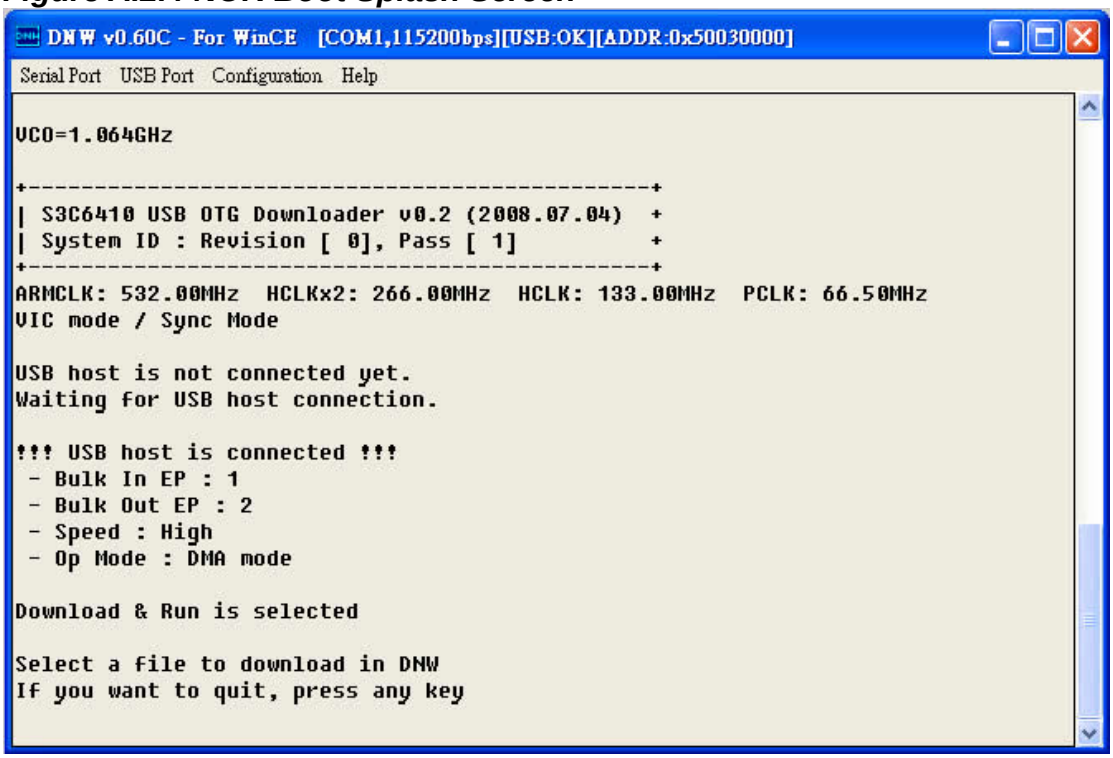
Figure A.2.3 COM and USB Port Setting of DNW Program



Step 1

Power on the device and you should see the following screen in your DNW programs as shown in figure A.2.4.

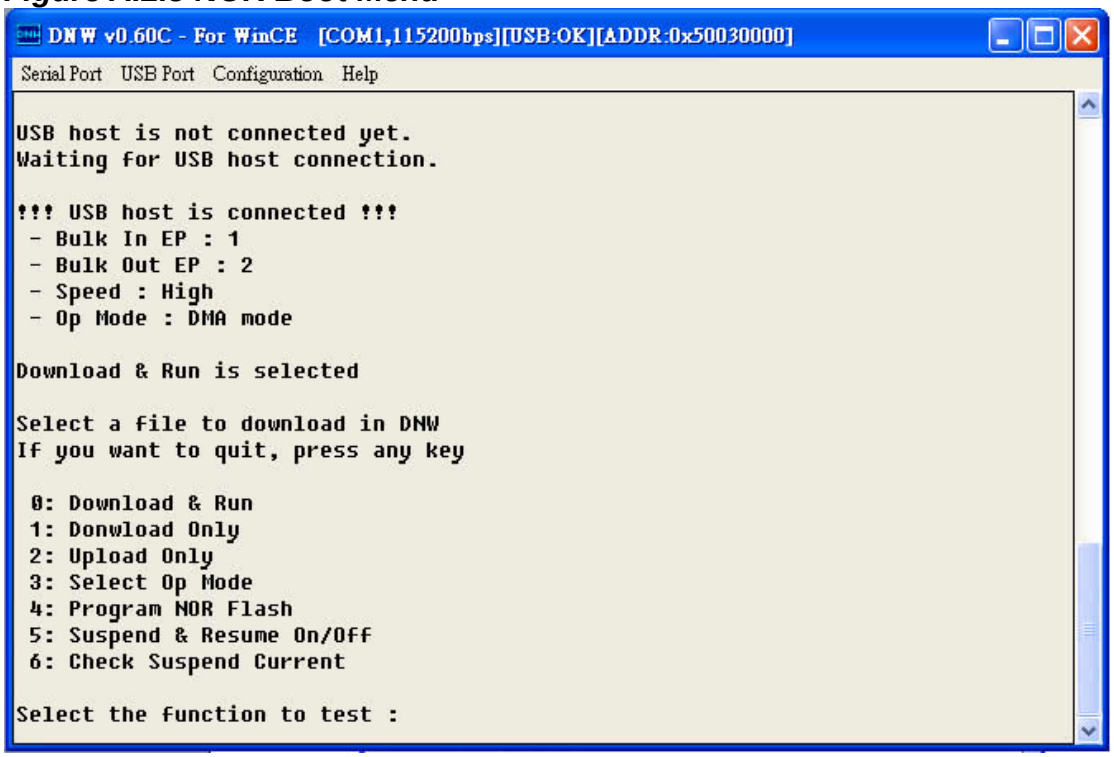
Figure A.2.4 NOR Boot Splash Screen


DNW v0.60C - For WinCE [COM1,115200bps][USB:OK][ADDR:0x50030000]
Serial Port USB Port Configuration Help
VCO=1.064GHz
+--+
| S3C6410 USB OTG Downloader v0.2 (2008.07.04) +
| System ID : Revision [0], Pass [1] +
+--+
ARMCLK: 532.00MHz HCLKx2: 266.00MHz HCLK: 133.00MHz PCLK: 66.50MHz
VIC mode / Sync Mode
USB host is not connected yet.
Waiting for USB host connection.
!!! USB host is connected !!!
- Bulk In EP : 1
- Bulk Out EP : 2
- Speed : High
- Op Mode : DMA mode
Download & Run is selected
Select a file to download in DNW
If you want to quit, press any key

Step 2

Press any key and you will enter the main menu as shown in figure A.2.5.

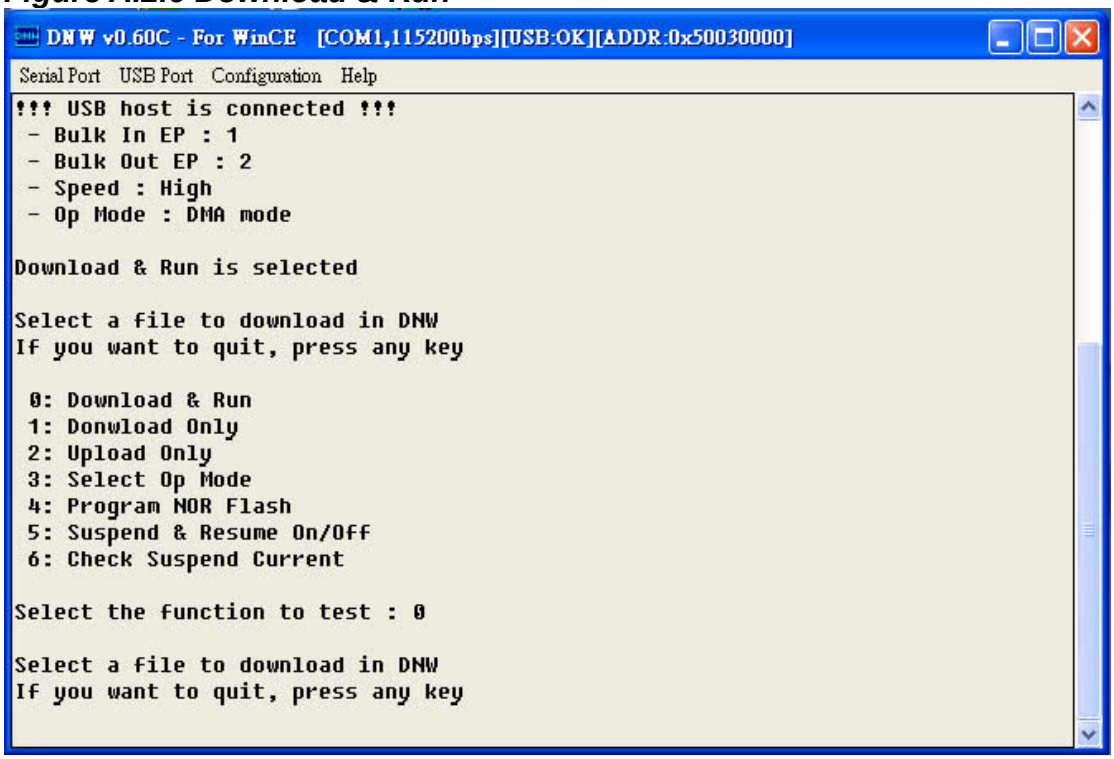
Figure A.2.5 NOR Boot Menu


DNW v0.60C - For WinCE [COM1,115200bps][USB:OK][ADDR:0x50030000]
Serial Port USB Port Configuration Help
USB host is not connected yet.
Waiting for USB host connection.
!!! USB host is connected !!!
- Bulk In EP : 1
- Bulk Out EP : 2
- Speed : High
- Op Mode : DMA mode
Download & Run is selected
Select a file to download in DNW
If you want to quit, press any key
0: Download & Run
1: Donwload Only
2: Upload Only
3: Select Op Mode
4: Program NOR Flash
5: Suspend & Resume On/Off
6: Check Suspend Current
Select the function to test :

Step 3

Select the function "**0: Download & Run**" and press "**Enter**". You will see the following screen.

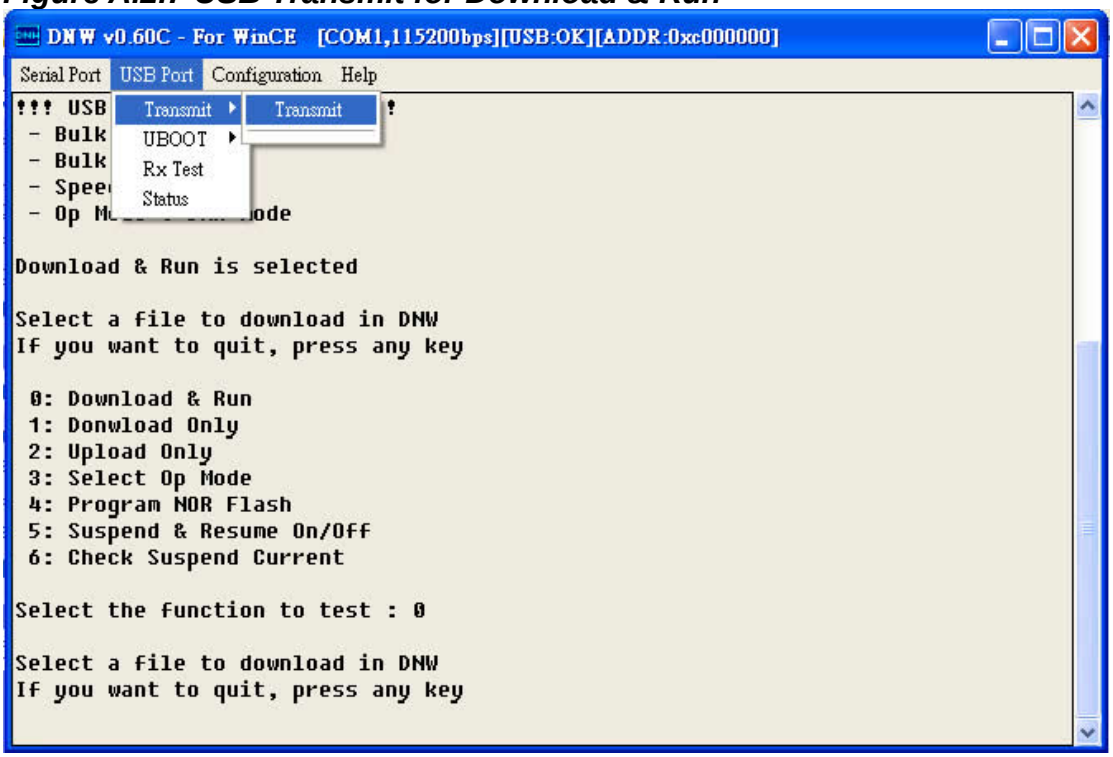
Figure A.2.6 Download & Run


DNW v0.60C - For WinCE [COM1,115200bps][USB:OK][ADDR:0x50030000]
Serial Port USB Port Configuration Help
!!! USB host is connected !!!
- Bulk In EP : 1
- Bulk Out EP : 2
- Speed : High
- Op Mode : DMA mode
Download & Run is selected
Select a file to download in DNW
If you want to quit, press any key
0: Download & Run
1: Donwload Only
2: Upload Only
3: Select Op Mode
4: Program NOR Flash
5: Suspend & Resume On/Off
6: Check Suspend Current
Select the function to test : 0
Select a file to download in DNW
If you want to quit, press any key

Step 4

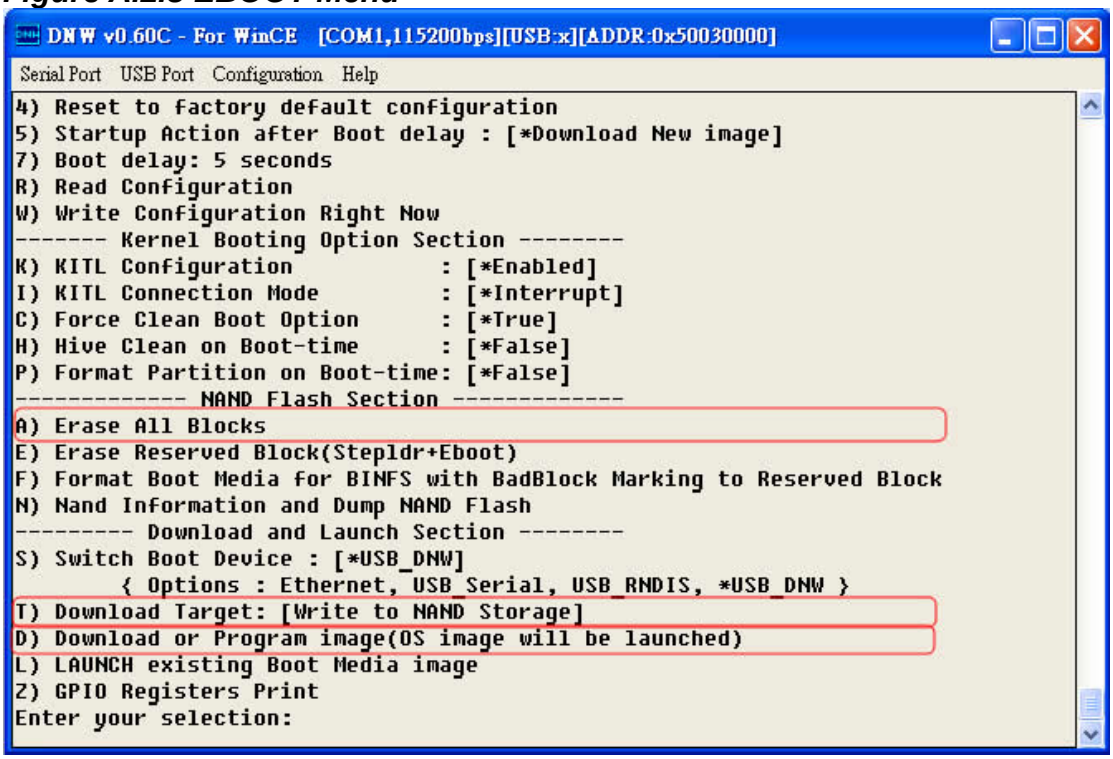
At “**USB Port**” Tab, Select "**Tramsmit**" → “**Transmit**” as figure A.2.7 shown.

Figure A.2.7 USB Transmit for Download & Run



A file browser will pop up and select the folder where you put the **EBOOT.nb0** file. Then the EBOOT will be download the DDR RAM and run. You will see the EBOOT “initiating image download in 5 seconds” messages. Press [**Space**] bar to enter the EBOOT menu during these 5 seconds as shown in figure A.2.8.

Figure A.2.8 EBOOT Menu

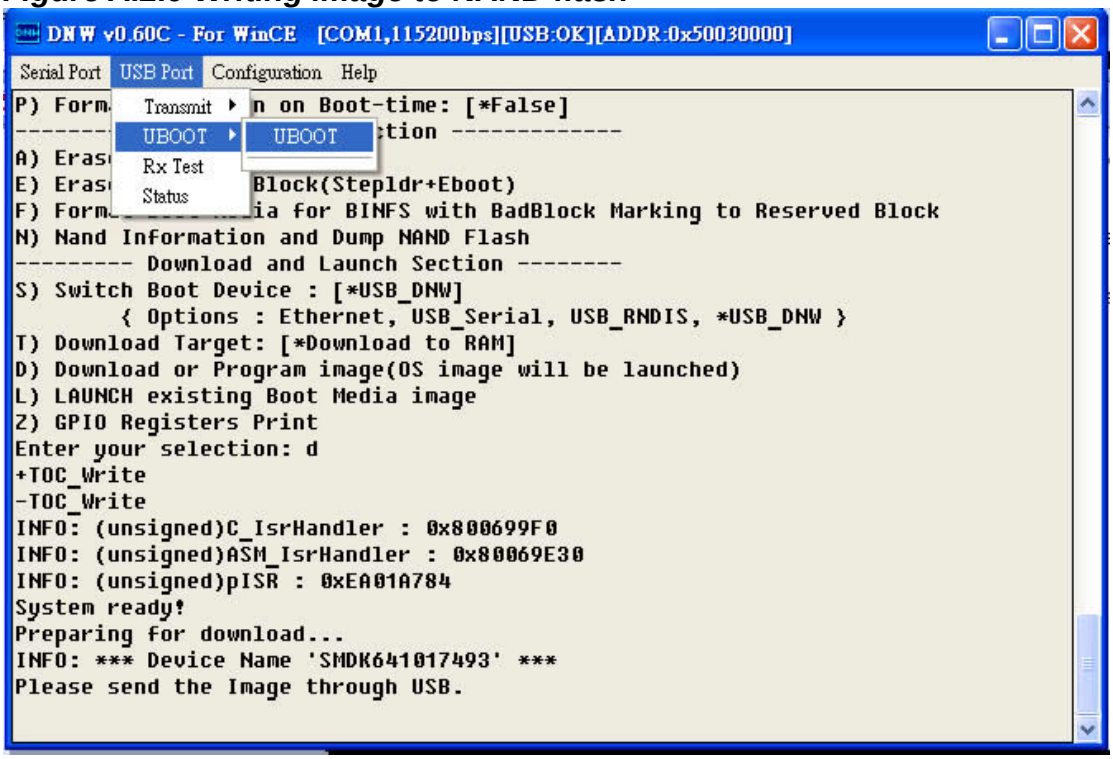

DNW v0.60C - For WinCE [COM1,115200bps][USB:x][ADDR:0x50030000]
Serial Port USB Port Configuration Help
4) Reset to factory default configuration
5) Startup Action after Boot delay : [*Download New image]
7) Boot delay: 5 seconds
R) Read Configuration
W) Write Configuration Right Now
------- Kernel Booting Option Section --------
K) KITL Configuration : [*Enabled]
I) KITL Connection Mode : [*Interrupt]
C) Force Clean Boot Option : [*True]
H) Hive Clean on Boot-time : [*False]
P) Format Partition on Boot-time: [*False]
------------- NAND Flash Section -------------
A) Erase All Blocks
E) Erase Reserved Block(Stepldr+Eboot)
F) Format Boot Media for BINFS with BadBlock Marking to Reserved Block
N) Nand Information and Dump NAND Flash
--------- Download and Launch Section --------
S) Switch Boot Device : [*USB_DNW]
{ Options : Ethernet, USB_Serial, USB_RNDIS, *USB_DNW }
T) Download Target: [Write to NAND Storage]
D) Download or Program image(OS image will be launched)
L) LAUNCH existing Boot Media image
Z) GPIO Registers Print
Enter your selection:

Step 5

First of all, we recommend you press **A) Erase All Blocks** to erase everything in NAND flash.
Next, press **T) Download Target: [*Download to RAM]** and change to **T) Download Target: [Write to NAND Storage**]. (By pressing "**T**" and you can change back and forth.) This is to tell EBOOT that we are going to write image to NAND flash instead of DDR RAM. Press "**W**" to save this EBOOT configuration.
And press **D) Download or Program image (OS image will be launched)**
You will see the following screen shown as figure A.2.9.

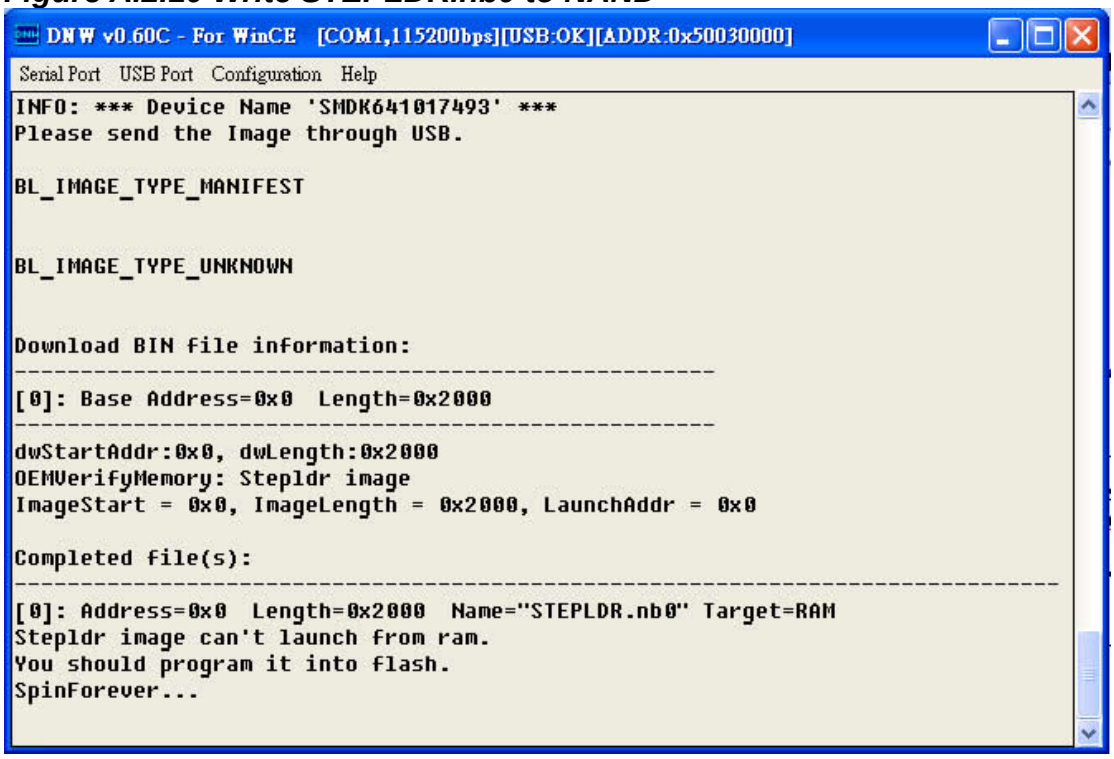
Step 6

Figure A.2.9 Writing image to NAND flash



At "**USB Port**" Tab, select **UBOOT → UBOOT** as shown in figure A.2.9. (Note: because we are going to write image to NAND flash, choose UBOOT instead Transmit. Here is different from that in step 4.) A file browser will ask you to select a file that you would like to write to NAND flash. Find the file "**STEPLDR.nb0**" in your PC and click. And you will see the following screen as shown in figure A.2.10.

Figure A.2.10 Write STEPLDR.nb0 to NAND

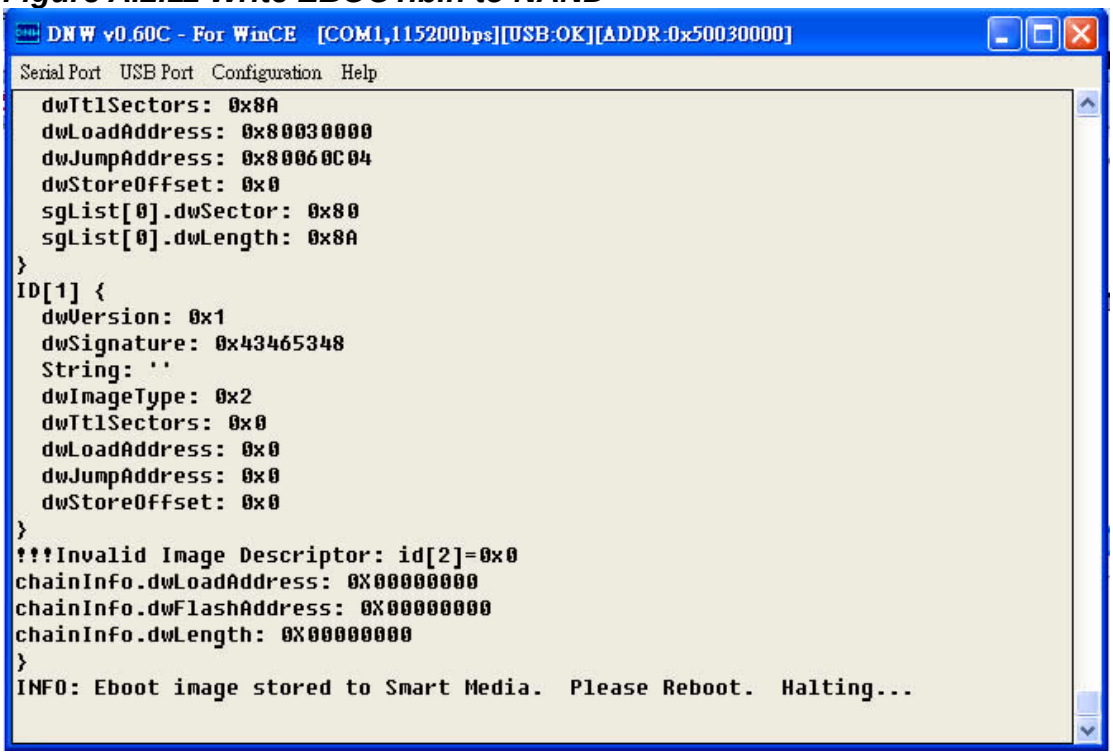

DNW v0.60C - For WinCE [COM1,115200bps][USB:OK][ADDR:0x50030000]
Serial Port USB Port Configuration Help
INFO: *** Device Name 'SMDK641017493' ***
Please send the Image through USB.
BL_IMAGE_TYPE_MANIFEST
BL_IMAGE_TYPE_UNKNOWN
Download BIN file information:
[0]: Base Address=0x0 Length=0x2000
dwStartAddr:0x0, dwLength:0x2000
OEMVerifyMemory: Stepldr image
ImageStart = 0x0, ImageLength = 0x2000, LaunchAddr = 0x0
Completed file(s):
[0]: Address=0x0 Length=0x2000 Name="STEPLDR.nb0" Target=RAM
Stepldr image can't launch from ram.
You should program it into flash.
SpinForever...

Now you have successfully write the STEPLDR.nb0 file to NAND flash. Next, we would like to write **EBOOT.bin** to NAND flash.

Step 7

Repeat steps 1~6, but **DON'T** erase all blocks at step 5 because you have already written the STEPLDR.nb0 to NAND flash. And at step 6 choose the **EBOOT.bin** file. (Note: It is EBOOT.bin instead of EBOOT.nb0.) After writing EBOOT.bin to NAND flash you should be able to see the screen as shown in figure A.2.11.

Figure A.2.11 Write EBOOT.bin to NAND



As of now you have successfully written the STEPLDR.nb0 and EBOOT.bin files to NAND flash.
You can turn the power off and set the JP1 jumper to NAND boot and turn the power on again. You should able to hear a short beep sound and see the splash screen on the LCD as shown in figure A.2.12.

Figure A.2.12 EBOOT Slash Screen

Next section, we are going to introduce how to restore/upgrade the NK image from NAND flash by using EBOOT.

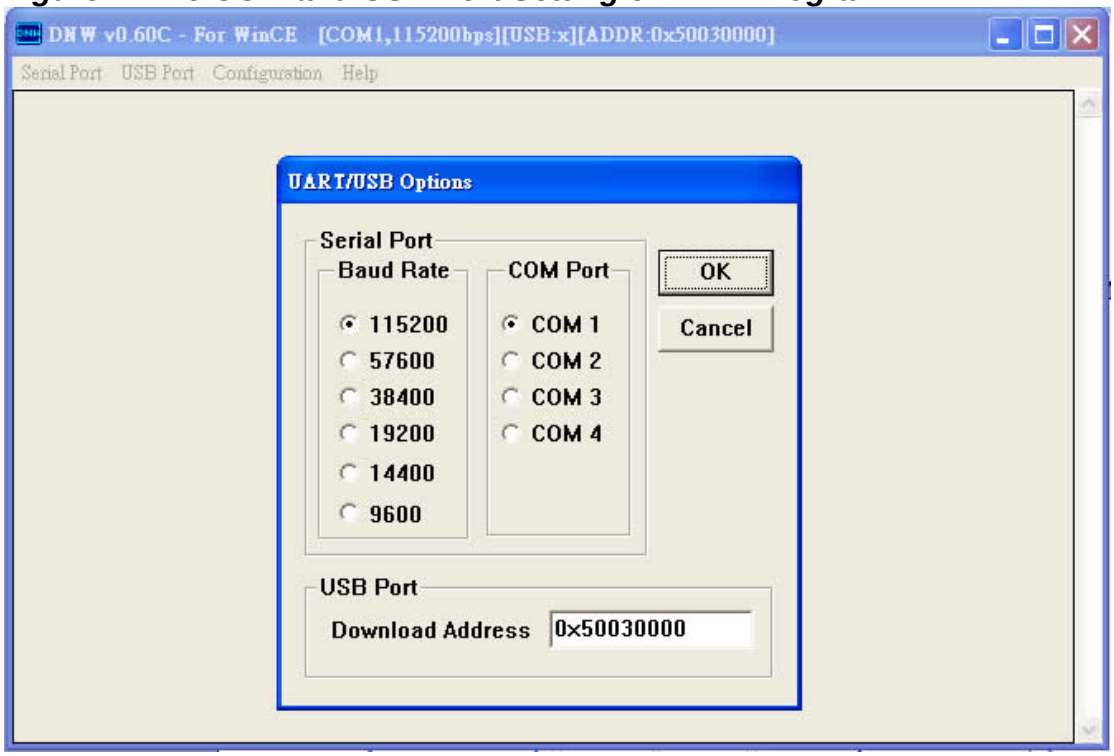
A.2.3 Restore NK image from EBOOT

In previous section, we detailed how to restore/upgrade the steploader and EBOOT from NOR flash utilities. Once you have steploader and eboot up and running in NAND flash. You can use the EBOOT to restore or upgrade the NK image.

Same as section 3.1, first, you need to connect the serial console cable from serial console port (UART 0 in CN20 of Embedian SBC) of device to the COM port of your Windows PC. And connect a USB cable from USB device port (CN19 of Embedian SBC) to USB host port of your Windows PC.

In "**Serial Port**" of your dnw program, click on "**Connect**" and power on device. In "**Configuration**" of dnw program, at "**Options**" set the COM port as the following setting of figure A.2.13. And the USB Port Download Address is "***0x50030000***", this is the DDR DRAM address where the program will be executed. The baud rate is 115200 and the host COM port is this example is "**COM 1**"

Figure A.2.13 COM and USB Port Setting of DNW Program

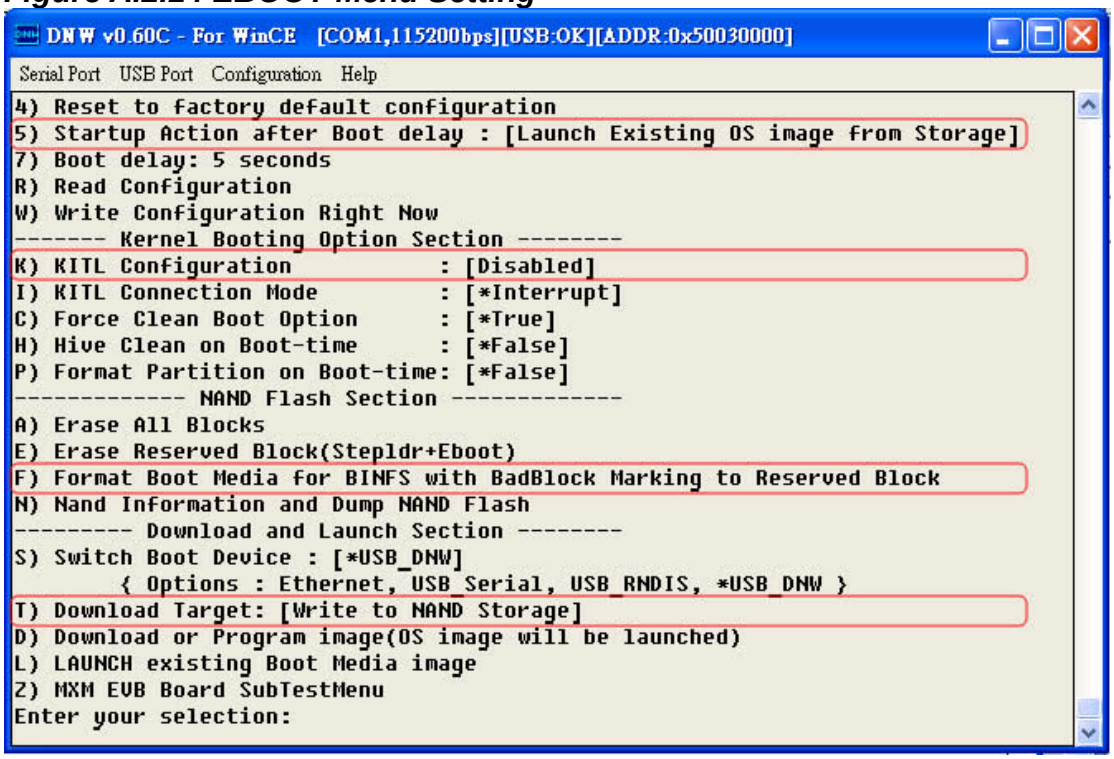


Following is a step-by-step guide.

Step 1

Set the JP1 to NAND boot (open 1-2 pin of JP1) and power up the devices. You should be able to hear a short beep sound and splash screen in the LCD. You will see the EBOOT "initiating image download in 5 seconds" messages. Press [**Space**] bar to enter the EBOOT menu during these 5 seconds as shown in figure A.2.14.

Figure A.2.14 EBOOT Menu Setting


DNW v0.60C - For WinCE [COM1,115200bps][USB:OK][ADDR:0x50030000]
Serial Port USB Port Configuration Help
4) Reset to factory default configuration
5) Startup Action after Boot delay : [Launch Existing OS image from Storage]
7) Boot delay: 5 seconds
R) Read Configuration
W) Write Configuration Right Now
------- Kernel Booting Option Section --------
K) KITL Configuration : [Disabled]
I) KITL Connection Mode : [*Interrupt]
C) Force Clean Boot Option : [*True]
H) Hive Clean on Boot-time : [*False]
P) Format Partition on Boot-time: [*False]
------------ NAND Flash Section -------------
A) Erase All Blocks
E) Erase Reserved Block(Stepldr+Eboot)
F) Format Boot Media for BINFS with BadBlock Marking to Reserved Block
N) Nand Information and Dump NAND Flash
--------- Download and Launch Section --------
S) Switch Boot Device : [*USB_DNW]
{ Options : Ethernet, USB_Serial, USB_RNDIS, *USB_DNW }
T) Download Target: [Write to NAND Storage]
D) Download or Program image(OS image will be launched)
L) LAUNCH existing Boot Media image
Z) MXM EVB Board SubTestMenu
Enter your selection:

Step 2

First of all, press **5) Startup Action after Boot delay: [Launch Existing OS image from Storage]** to tell EBOOT to load the NK from NAND flash because we are going to erite NK to NAND flash later. (The default setting should be 5) Startup Action after Boot delay : [*Download New image]. Press "**5**" to change it.)
Next, press **K) KITL Configuration : [Disabled]** to disable the KITL.
Press "**W**" to save this configuration first.
And next, press **F) Format Boot Media for BINFS with BadBlock Marking to Reserved Block.** This is to format the NK area as BinFS file system and mark the bad blocks in NAND flash.
You will see the following message shortly and then enter into the EBOOT menu again.

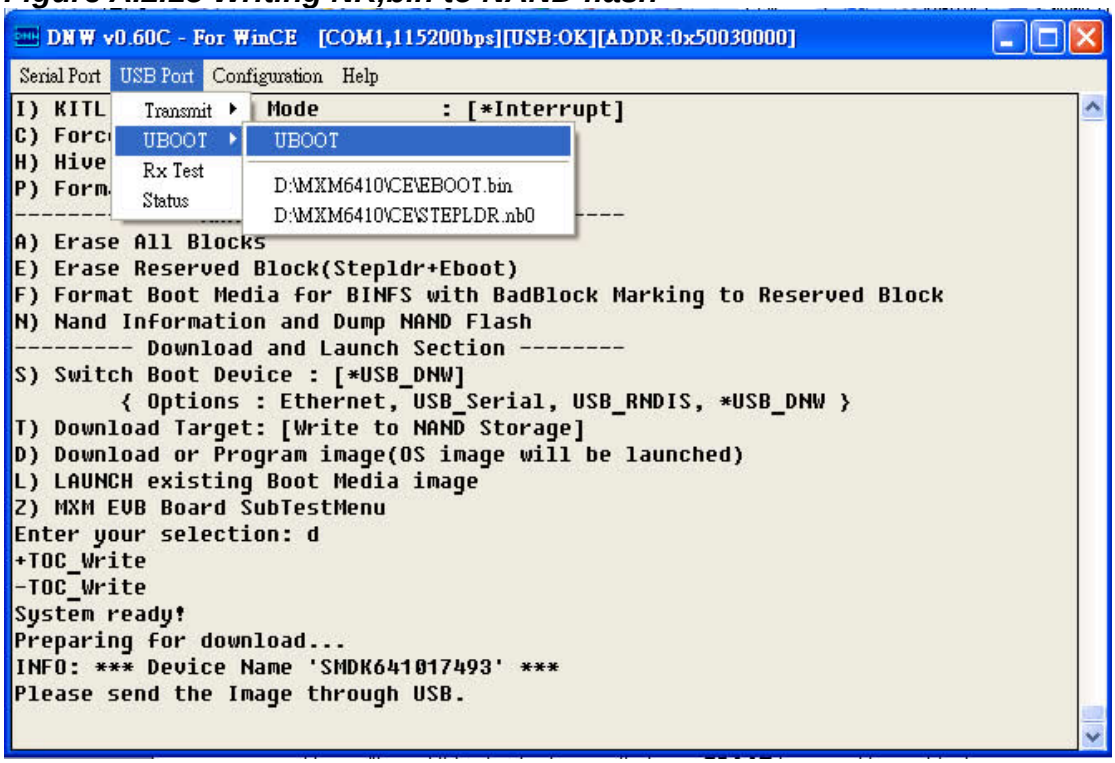
Enter your selection: f
Reserving Blocks [0x0 - 0x5] ... Wait for completion

Reserving is completed.

The last step is to writing **NK.bin** image into NAND flash by pressing **D) Download or Program image (OS image will be launched)**

And you will see the following screen as shown in figure A.2.15.

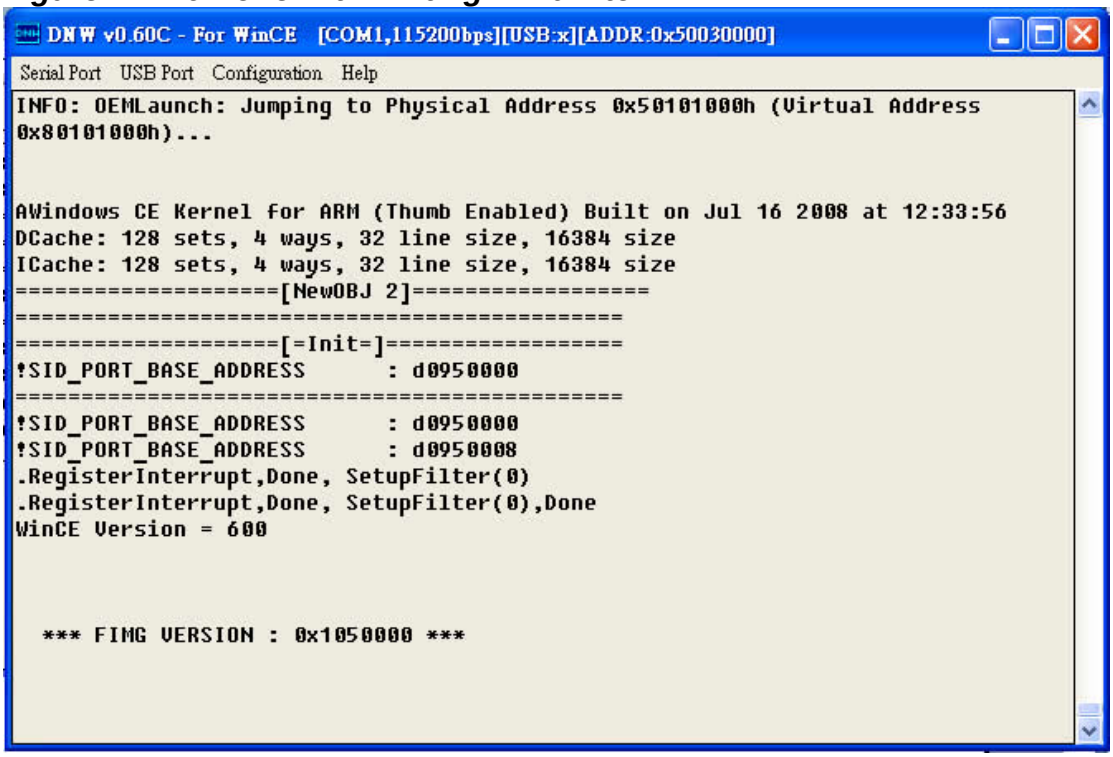
Figure A.2.15 Writing NK,bin to NAND flash



Step 3

At "**USB Port**" Tab, select **UBOOT → UBOOT** as shown in figure A.2.15. (Note: because we are going to write image to NAND flash, choose UBOOT instead Transmit.) A file browser will ask you to select a file that you would like to write to NAND flash. Find the file "**NK.bin**" in your PC and click. Wait for about 30 seconds to let the NK.bin writing into NAND flash. And you will see the following screen as shown in figure A.2.16.

Figure A.2.16 Done with Writing NK.bin to NAND


DNW v0.60C - For WinCE [COM1,115200bps][USB:x][ADDR:0x50030000]
Serial Port USB Port Configuration Help
INFO: OEMLaunch: Jumping to Physical Address 0x50101000h (Virtual Address 0x80101000h)...
AWindows CE Kernel for ARM (Thumb Enabled) Built on Jul 16 2008 at 12:33:56
DCache: 128 sets, 4 ways, 32 line size, 16384 size
ICache: 128 sets, 4 ways, 32 line size, 16384 size
====================[NewOBJ 2]==================
==
====================[=Init=]==================
!SID_PORT_BASE_ADDRESS : d0950000
==
!SID_PORT_BASE_ADDRESS : d0950000
!SID_PORT_BASE_ADDRESS : d0950008
.RegisterInterrupt,Done, SetupFilter(0)
.RegisterInterrupt,Done, SetupFilter(0),Done
WinCE Version = 600
*** FIMG VERSION : 0x1050000 ***

If you have ActiveSync program (user can download this program for free from Microsoft's website) installed in your Windows PC and the USB cable is connected to your device, you should be able to see the ActiveSync program pop out and ask you to set up a partnership as shown in figure A.2.17.

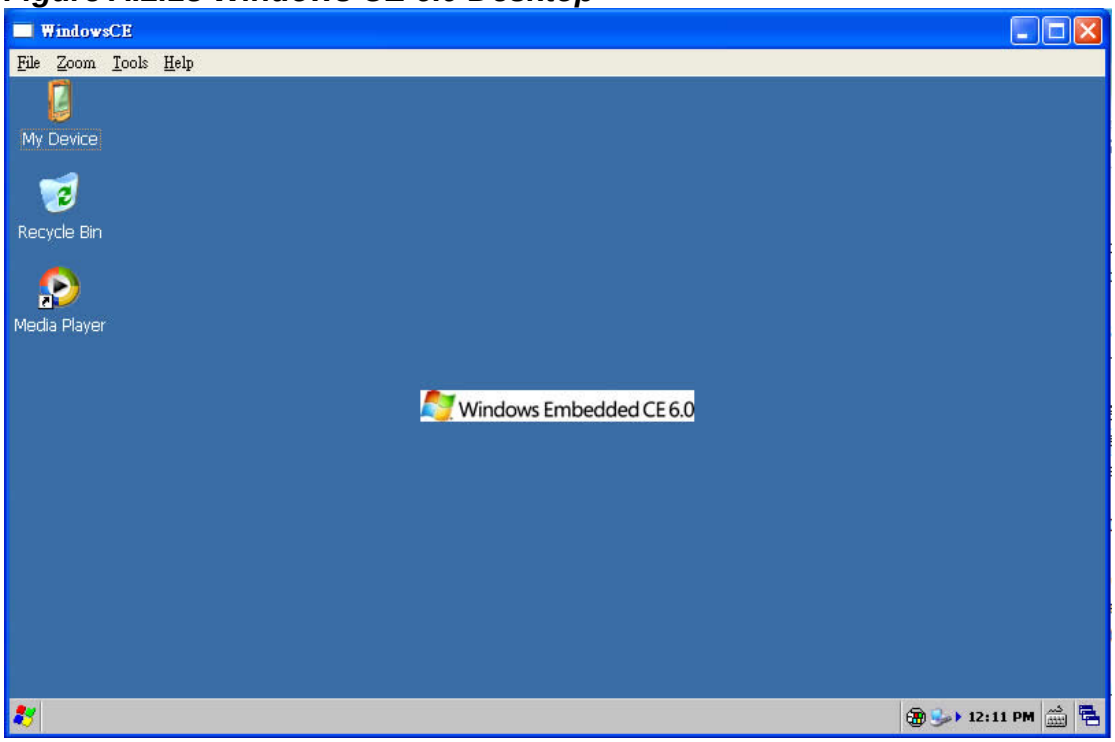
Figure A.2.17 ActiveSync Program

New Partnership
Set Up a Partnership
Before you can synchronize information between your mobile device and this computer, you must set up a partnership between them.
Would you like to set up a partnership?
Yes
Set up a partnership so that I can synchronize information between my device and this computer.
No
I don't want to synchronize information. Set up my device as a guest so that I can copy or move information between my device and this computer.
< 上一步(B)
下一步(N) >
取消
說明

Select “**No**” and click “**Next**” of your ActiveSync program.

If you have LCD connected to the device, you should be able to see the Windows CE 6.0 desktop screen as following now. You can also use the remote desktop tool to see the desktop.

Figure A.2.18 Windows CE 6.0 Desktop



Now, we have done the firmware restore/upgrade of the Windows CE system.

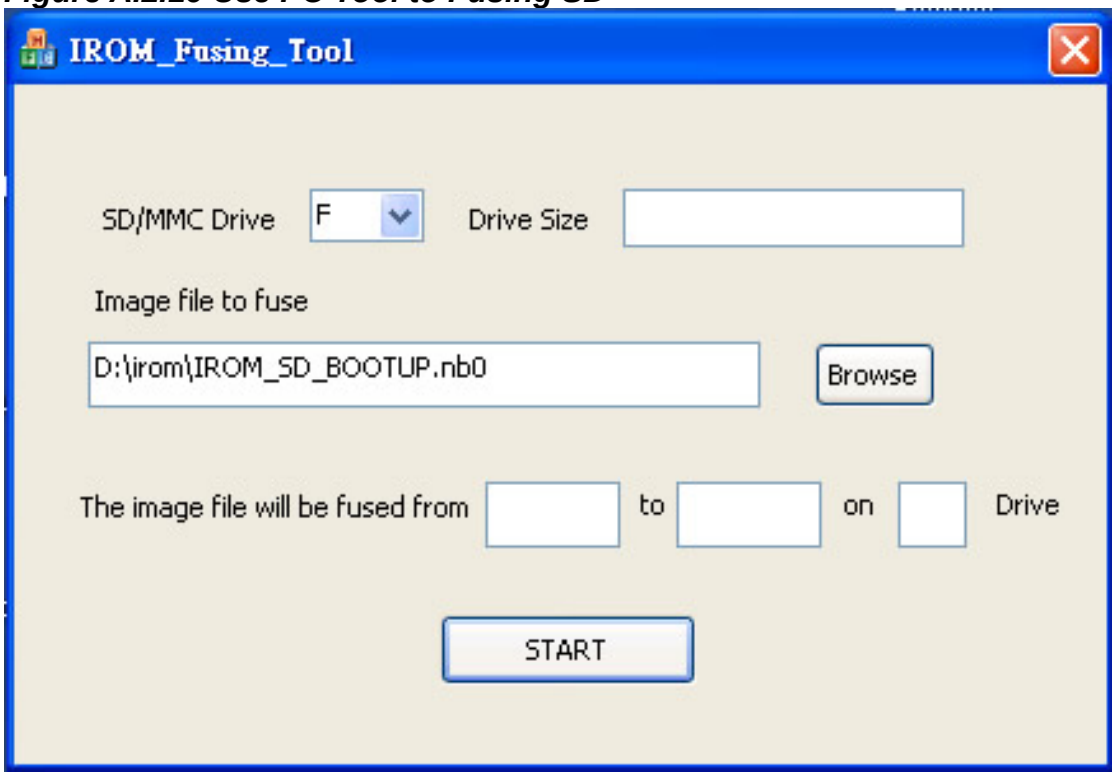
A.2.4 Restore firmware in NAND flash from SD Boot

Embedian also provides a very useful way to recover the firmware in NAND flash from SD card. To brief how this be done, use needs to use the PC tool to write the EBOOT bootable file to a SD card first and then plug that SD card into the device. Set the hardware configuration to SD boot and user will see the EBOOT menu. Details will be described in the following sections.

A.2.4.1. Using PC Tool to Fusing the SD/SDHC card

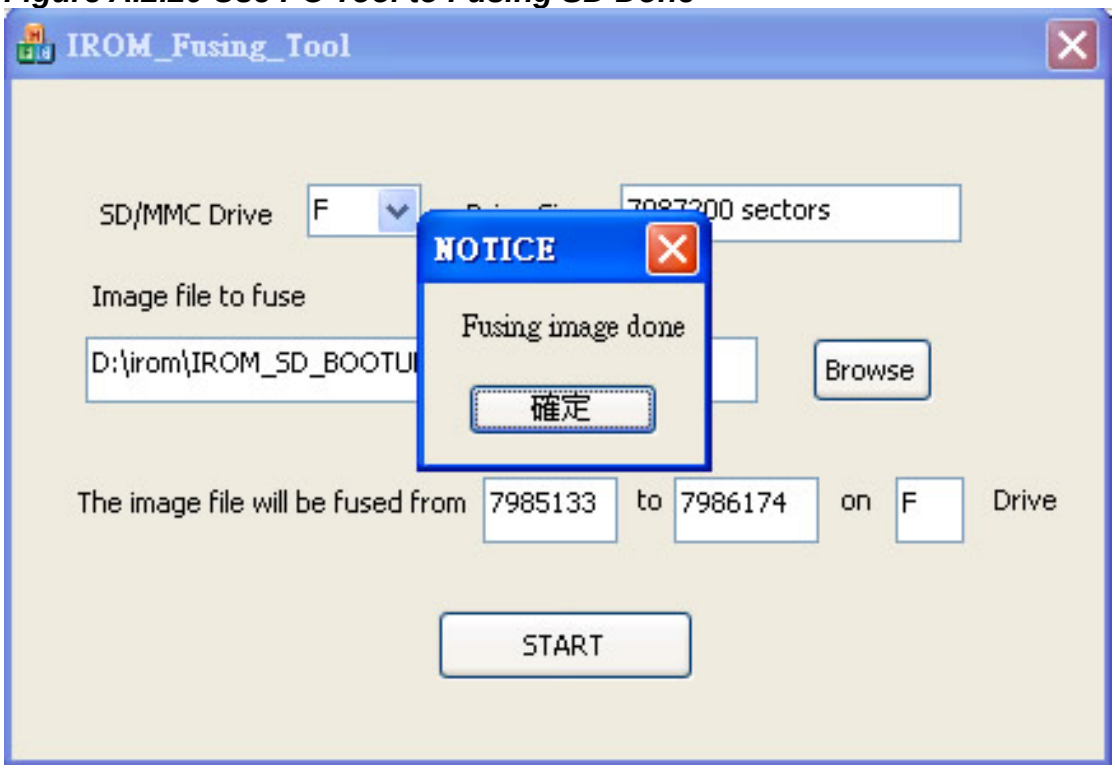
1. Users should format the SD/SDHC card as FAT32 file systems.
2. Run IROM_Fusing_Tool.exe (Note: for only SD, MMC, HSMMC card only, not SDHC card. Using IROM_Fusing_Tool_SDHC.exe instead if SDHC cards.)
3. Click the browse button to choose IROM_SD_BOOTUP.nb0. (Note: this file already combined the stepldr.nb0, just fusing this file will be fine enough.)
4. Choose the storage drive that SD card is mounted on**. If you choose **NOT** SD card storage drive like HDD drive, It might make a serious problem on your HDD. Please Make sure that storage drive is right.**

Figure A.2.19 Use PC Tool to Fusing SD



5. Click “START” button.

Figure A.2.20 Use PC Tool to Fusing SD Done



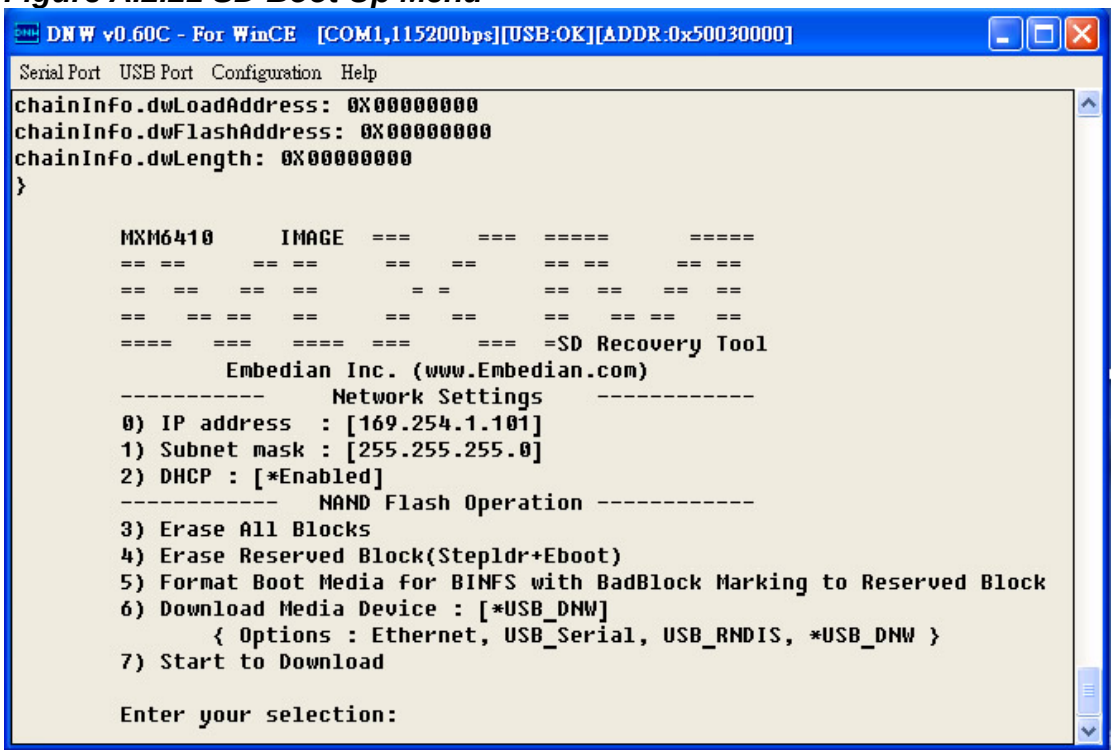
6. If there is the message box like that shown in figure A.2.20, it's done.
7. Remove the SD/MMC card from your PC and put it to APC-6410's SD card slot.
8. Set booting mode as iROM SD booting (shunt jumper block JP5), and turn on the power and you should see the system boot directly from SD now.

Next section, we will detail how to fusing NAND flash using SD boot.

A.2.4.2. Using SD boot fusing NAND flash

After setting the device to SD boot (shunt jumper block JP5), user should be able to see the following screen after power up.

Figure A.2.21 SD Boot Up Menu


DNW v0.60C - For WinCE [COM1,115200bps][USB:OK][ADDR:0x50030000]
Serial Port USB Port Configuration Help
chainInfo.dwLoadAddress: 0X00000000
chainInfo.dwFlashAddress: 0X00000000
chainInfo.dwLength: 0X00000000
}
MXM6410 IMAGE
=SD Recovery Tool
Embedian Inc. (www.Embedian.com)
Network Settings
0) IP address : [169.254.1.101]
1) Subnet mask : [255.255.255.0]
2) DHCP : [*Enabled]
NAND Flash Operation
3) Erase All Blocks
4) Erase Reserved Block(Stepldr+Eboot)
5) Format Boot Media for BINFS with BadBlock Marking to Reserved Block
6) Download Media Device : [*USB_DNW]
{ Options : Ethernet, USB_Serial, USB_RNDIS, *USB_DNW }
7) Start to Download
Enter your selection:

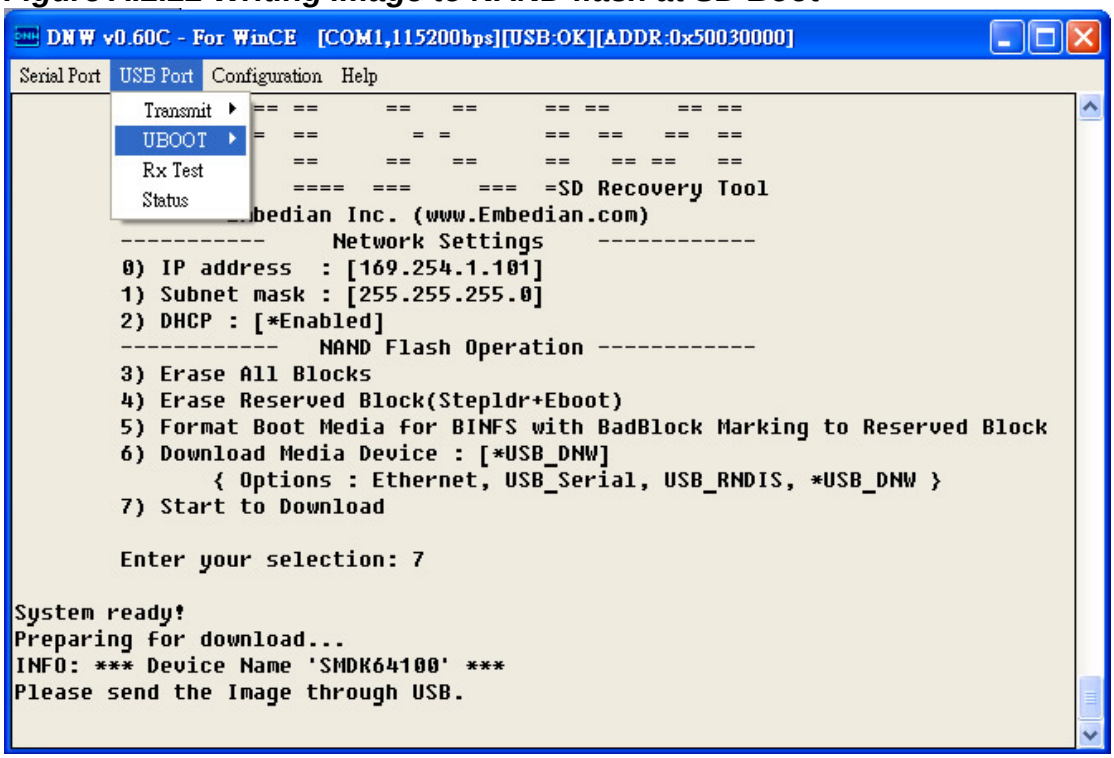
Once you saw the menu shown in figure A.2.21. The fusing procedure will be exactly the same as described in section A.2.2 to restore the NAND flash firmware from NOR flash. The following are the detail step-by-step procedures.

Step 1

First of all, we recommend you press **3) Erase All Blocks** to erase everything in NAND flash.
Next, press **6) Download Media Device : [*USB_DNW]** to choose "USB_DNW" and press **7) Start to Download.**
You will see the following screen shown as figure A.2.22.

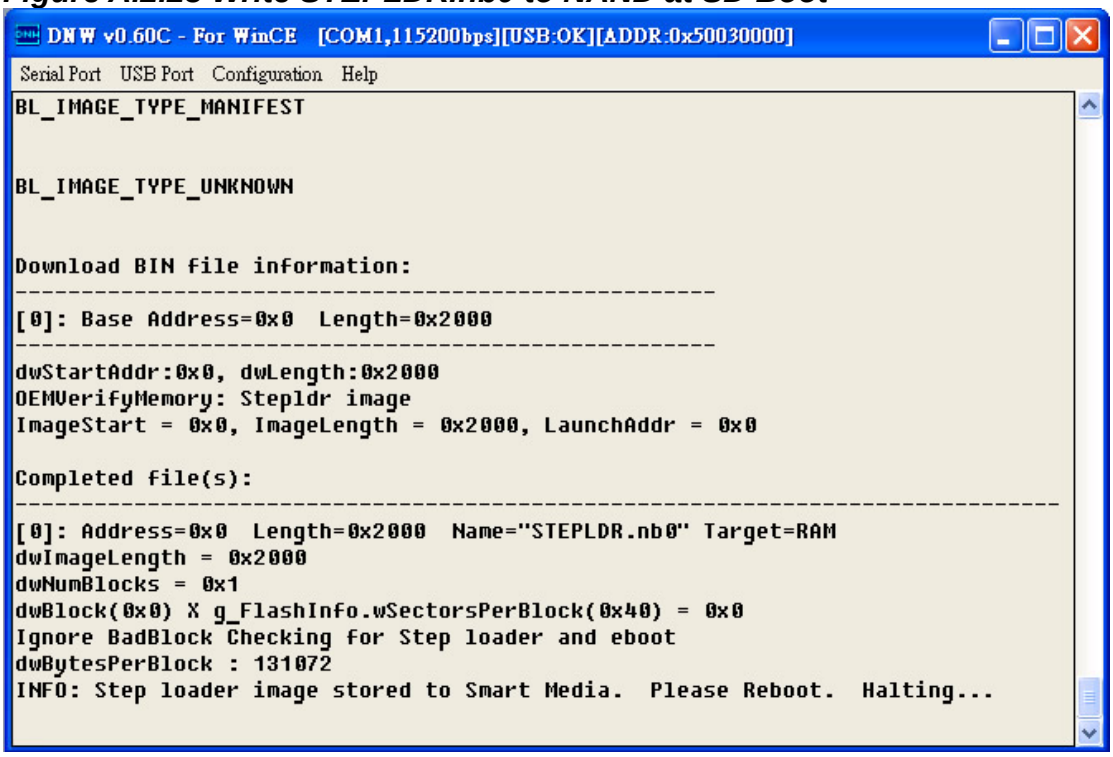
Step 2

Figure A.2.22 Writing image to NAND flash at SD Boot



At "**USB Port**" Tab, select **UBOOT → UBOOT** as shown in figure A.2.22. A file browser will ask you to select a file that you would like to write to NAND flash. Find the file "**STEPLDR.nb0**" in your PC and click. And you will see the following screen as shown in figure A.2.23.

Figure A.2.23 Write STEPLDR.nb0 to NAND at SD Boot

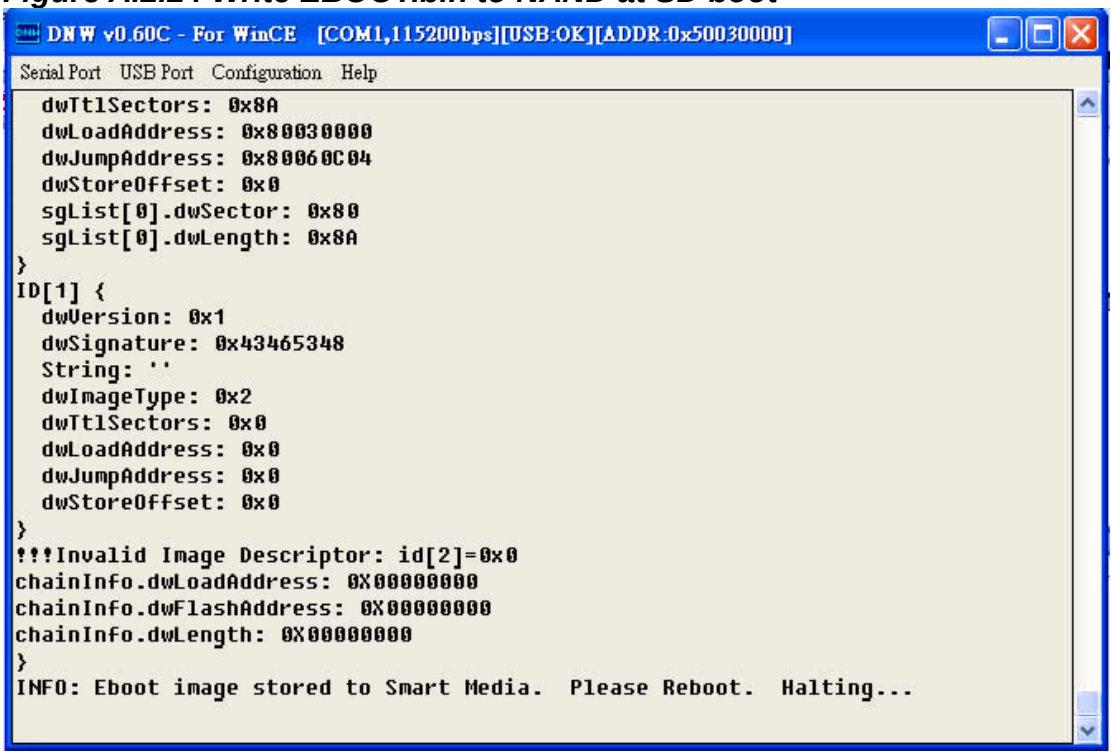

DNW v0.60C - For WinCE [COM1,115200bps][USB:OK][ADDR:0x50030000]
Serial Port USB Port Configuration Help
BL_IMAGE_TYPE_MANIFEST
BL_IMAGE_TYPE_UNKNOWN
Download BIN file information:
[0]: Base Address=0x0 Length=0x2000
dwStartAddr:0x0, dwLength:0x2000
OEMVerifyMemory: Stepldr image
ImageStart = 0x0, ImageLength = 0x2000, LaunchAddr = 0x0
Completed file(s):
[0]: Address=0x0 Length=0x2000 Name="STEPLDR.nb0" Target=RAM
dwImageLength = 0x2000
dwNumBlocks = 0x1
dwBlock(0x0) X g_FlashInfo.wSectorsPerBlock(0x40) = 0x0
Ignore BadBlock Checking for Step loader and eboot
dwBytesPerBlock : 131072
INFO: Step loader image stored to Smart Media. Please Reboot. Halting...

Now you have successfully write the STEPLDR.nb0 file to NAND flash. Next, we would like to write **EBOOT.bin** to NAND flash.

Step 3

Repeat steps 1~2, but **DON'T** erase all blocks at step 1 because you have already written the STEPLDR.nb0 to NAND flash. And at step 2 choose the **EBOOT.bin** file. (Note: It is EBOOT.bin instead of EBOOT.nb0.) After writing EBOOT.bin to NAND flash you should be able to see the screen as shown in figure A.2.24.

Figure A.2.24 Write EBOOT.bin to NAND at SD boot



As of now you have successfully written the STEPLDR.nb0 and EBOOT.bin files to NAND flash.
You can turn the power off and set the jumper to NAND boot and turn the power on again. You should able to hear a short beep sound and see the splash screen on the LCD as shown in figure A.2.25.

Figure A.2.25 EBOOT Slash Screen

Users now can go back to section A.2.3 to see how to restore/upgrade the NK image from NAND flash by using EBOOT at NAND.